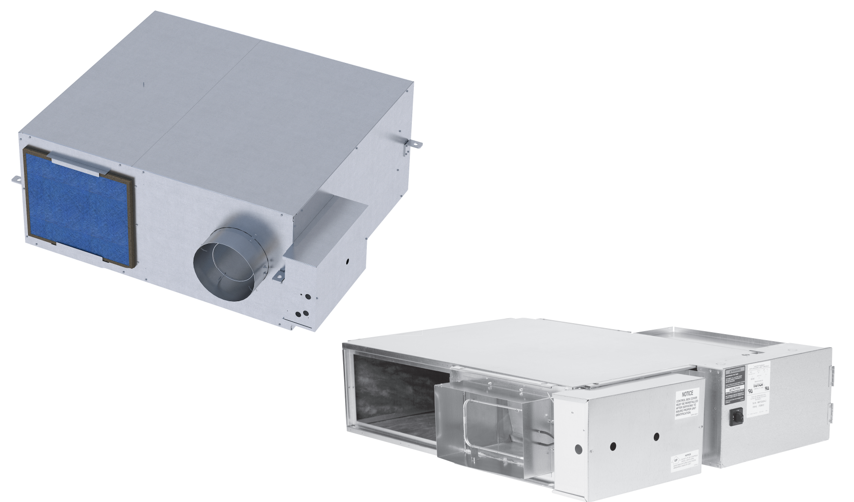
Product Catalog

VariTrane™ Fan-Powered

Parallel

VP*G, LP*F



November 2025

VAV-PRC012AF-EN

Introduction

This catalog includes parallel fan-powered VAV terminals, including standard and low height models. As an option, these terminals can be equipped with hot-water heating coils or electric heaters.

Figure 1. Parallel fan-powered terminal unit - cooling only (VPCG)

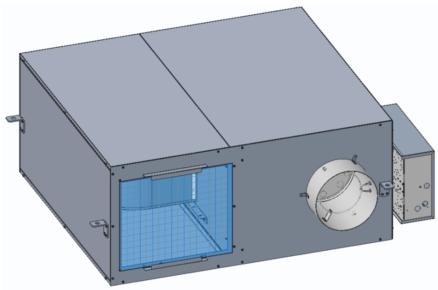


Figure 2. Parallel fan-powered terminal unit - hot water (VPWG)

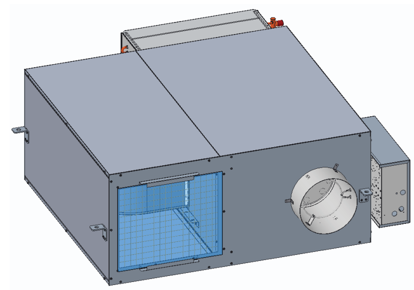


Figure 3. Parallel fan-powered terminal unit - electric heat (VPEG)

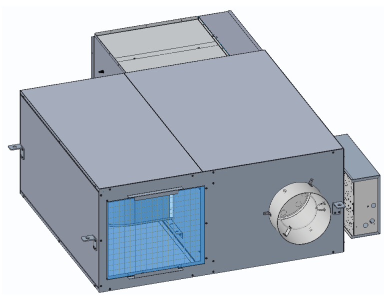


Figure 4. Low height parallel: LPEF

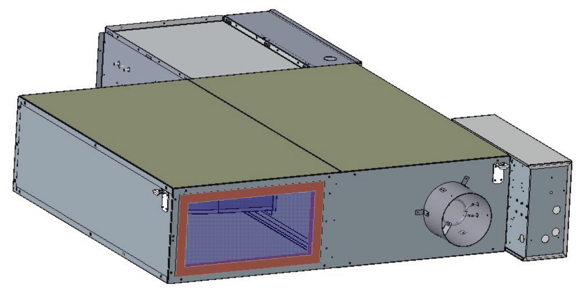


Figure 5. Low height parallel: LPWF

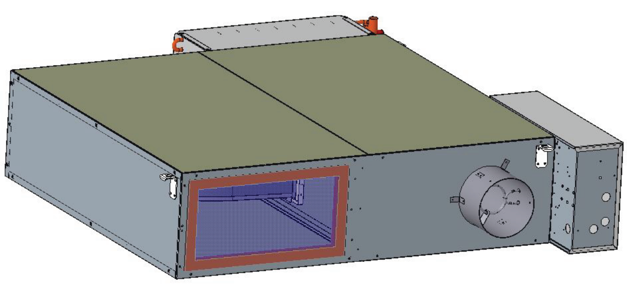
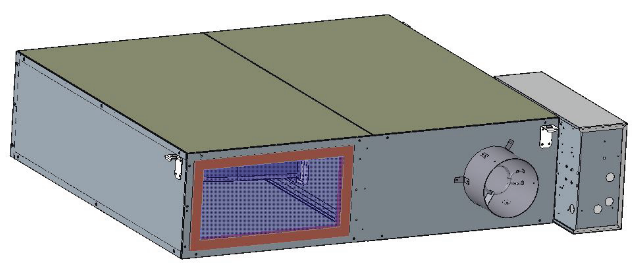


Figure 6. Low height parallel: LPCF



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Revision History

- Updated the model number from VP*F to VP*G in the Features and Benefits, Application Considerations, Selection Procedure, Model Number Descriptions, Performance Data, Electrical Data, Acoustics Data, Dimensional Data, and Mechanical Specifications: Fan-Powered chapters.
- Removed UC400 from Features and Benefits and Model Number Description chapters.

Table of Contents

Features and Benefits

VariTrane

Parallel fan-powered units offer energy savings with intermittent fan control. The fan energizes only in heating mode when the space needs heat. When energized, the fan can be controlled for constant-speed or variable-speed operation. Additional energy savings are obtained by using warm plenum air for free reheat. Motor heat is never wasted in parallel units. They are an excellent choice when minimal zone heating is needed.

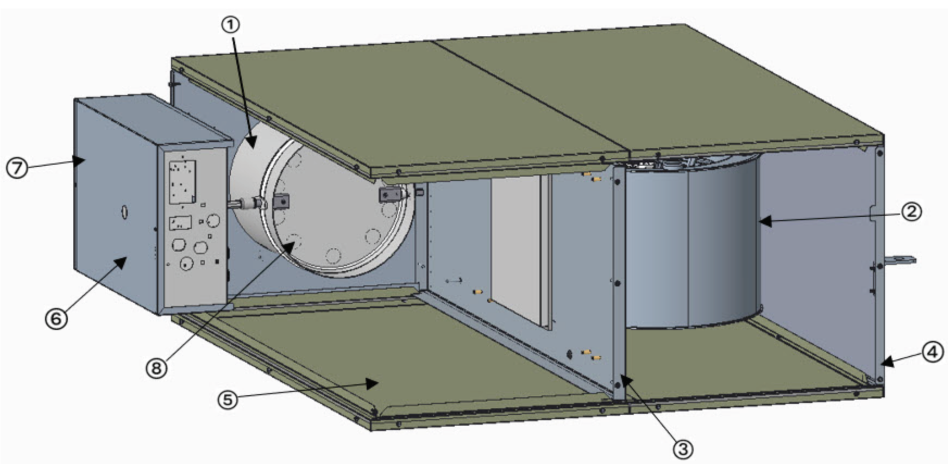
Energy Efficient Earthwise Systems

A significant consumer of energy in commercial buildings is heating and air conditioning.

Energy saving features include:

- Ventilation Optimization – Combines demand control ventilation (time of day schedule, an occupancy sensor, or a carbon dioxide sensor) at the zone level with ventilation reset at the system level. This will deliver the required amount of outdoor air to each zone, minimizing over ventilation.
- Fan Pressure Optimization – Reduces supply fan energy by intelligently reducing the pressure in the air distribution system to the lowest possible level without impacting occupant comfort.
- Night Setback – Reduces energy consumption during unoccupied periods by raising or lowering space temperature setpoints.
- Supply Air Temperature Reset – Reduces overall system energy use (balancing reduced cooling and reheat energy with increased fan energy) by raising the supply air temperature at part load, while avoiding elevated space humidity levels.
- Electrically Commutated Motors (ECM) – Improve the efficiency of fan-powered VAV units.
- Low Temperature Air Distribution – Can decrease overall system energy use by reducing airflow and fan energy needed to move that air through the system.

To determine the potential energy savings a VAV system can bring to your applications, Trane offers energy-modeling software like System Analyzer™ and Trace 3D Plus.



1	Rugged Air Valve – Trane air valves are heavy gage steel with a continuously welded seam to limit inlet deformation. This provides consistent and repeatable airflow across the flow ring with performance you can count on.
2	Technologically Advanced Units - Fan/motor/wheel assemblies are engineered as an air delivery system to provide efficiency.
3	Interlocking Panels – Patent-pending interlocking panels are designed using integral I-beam construction technology to create product rigidity. For exposed ceiling applications the exterior is smooth with few exposed screws. VariTrane™ units are designed for use in systems that operate up to 5 inches w.c. inlet static pressure.
4	Metal Encapsulated Edges – All VariTrane™ units include encapsulated edges to arrest cut fibers and prevent insulation erosion into the air stream. This is important for applications with fiberglass erosion and projects with either double-wall or externally wrapped duct work.
5	Full Range of Insulation – For optimal acoustical performance or cleanability, insulation options include, double-wall, matte-faced, foil-faced, closed cell.

6	Service Friendly: • Internal shaft visible through control box cover sight hole for blade orientation verification. • Same-side NEC jumpback clearance provides all high-voltage and low-voltage components on the same side to minimize field labor. • Fan powered units have improved accessibility to internal components. Top and bottom access panels are standard for a technician to safely service.
7	Control Flexibility – Trane VAVs offer factory installed, tested, and commissioned Trane BACnet® controllers. Trane can also factory mount and wire 3rd party controllers.
8	Flow Ring – Housed and recessed within the air valve to reduce the potential for damage during shipping and on the job site. The patented flow ring has been tested to perform under the most demanding conditions.

Casing Design

18-gauge cylinder	• Limits damage during shipment and job handling. • Provides even airflow distribution across the flow ring.
External shaft	• Provides controller flexibility. • Designed to facilitate actuator field replacement.
Position indicator	• Shows current air valve position to aid in system commissioning. • Visible from the floor.
External actuator	Increases serviceability, control system compatibility, and actuator clutch access for simplified commissioning.

Indoor Air Quality (IAQ) Features

System design should consider applicable ventilation and IAQ standards.

- Provide the required amount of outdoor air to each zone during all operating conditions.
- Limit particulates from entering occupied spaces.
- Allow proper access for periodic cleaning.

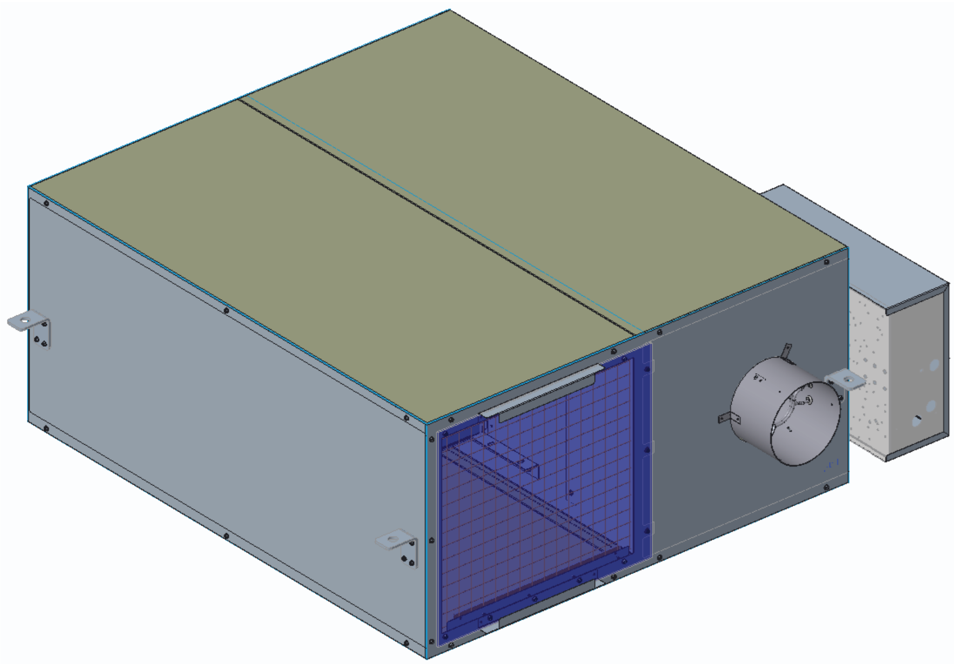


Table 1. Insulation options

Matte-faced	Typical industry standard with reduced first cost.
Closed-cell	• R-value and performance equivalent to matte-faced insulation. • Main difference is the reduction of water vapor transmission. • Closed-cell designed for use in installations with a high chance of water formation.
Foil-faced	Fiberglass insulation with a thin aluminum coating on the air stream side to prevent fibers from becoming airborne.
Double-wall	• Premium insulation with insulation locked between metal liners. • Eliminates the possibility for insulation entering the airstream. • Allows for unit interior wipe-down as needed.
LEED wrap option	• Pressure sensitive covering that prevents contamination of the VAV box during the construction phase. • Seal all openings without constraining the installation process.

Tracer Building Automation System

Tracer® Building Automation Systems ensure comfort within your building.

Building controls have a bigger job description than they did a few years ago. It's no longer enough to control heating and cooling systems and equipment. Sophisticated buildings require smarter technology that will carry into the future. Tracer controls provide the technology platform – mobile, easy-to-use, cloud-based, scalable and open - for the next generation of data-driven, technology-enabled services that are creating high performance buildings.

With a Trane Tracer Building Automation System, will:

- Reduce operating costs through energy management strategies.
- Consistently provide occupant comfort.
- Enjoy reliable operation with standard, pre-engineered, and pretested applications.
- Easily troubleshoot and monitor either on site or from a remote location.
- Reduce installation time and simplify troubleshooting.

Trane offers a wide range of factory or field installed controllers for a variety of applications. These units are compatible with a variety of building types and can be used for new construction or renovation. Through extensive usability testing internally and with building operators, controls are designed for ease of use.

Tracer BACnet® Controllers

Trane offers a full line of programmable BACnet controllers designed for simple integration into any system which can communicate via the BACnet protocol. Controllers are factory-programmed, commissioned, and shipped ready to be installed.

Air-Fi® Wireless System

For more detailed information on Air-Fi® Wireless systems and devices, see:

- *Air-Fi® Wireless Systems - Installation, Operation, and Maintenance* (BAS-SVX40*-EN)
- *Air-Fi® Wireless Product Systems - Product Data Sheet* (BAS-PRD021*-EN)
- *Air-Fi® Network Design - Installation, Operation, and Maintenance* (BAS-SVX55*-EN)

Air-Fi® Wireless Communications Interface (WCI)

A factory-installed Air-Fi® Wireless Communications Interface (WCI) provides wireless communication between the Tracer® SC and Symbio™ 210/500 VAV unit controllers and optionally, Air-Fi® Wireless Communication sensors.
The Air-Fi® WCI's wireless mesh network is the perfect alternative to a wired communication link. Eliminating the low-voltage wire between the zone sensor and the terminal unit controller, and between the unit controllers and the system controller will:

- Reduced installation time and associated risks.
- Completion of projects with fewer disruptions.
- Easier and more cost-effective re-configurations, expansions, and upgrades.

Air-Fi® Wireless Communication Sensor (WCS)

The Wireless Communications Sensor (WCS) communicates wirelessly to a Tracer® BACnet® unit controller that has an Air-Fi® WCI installed. A WCS is an alternative to a wired sensor when access and routing of communication cable are issues. It also allows flexible mounting and relocation. Also available are a non-display version of the WCS with a temperature setpoint knob, an occupancy / CO_2 sensor / zone temperature version of the WCS, and a relative humidity (RH) sensor add-on board accessory.

Factory-installed vs. Factory-commissioned

The terms factory-installed and factory-commissioned are often used interchangeably. The following table differentiates these.

Factory-commissioned quality on VariTrane™ units is available on any manufacturer's control system that can communicate using BACnet® protocol.

Table 2. Factory-installed vs. factory-commissioned

	Factory-installed	Factory-commissioned
Transformer installed (option)	X	X
Wires terminated in reliable/consistent setting	X	X
Controller mounted	X	X
Electric heat contactors and fan relay wired	X	X
Controller addressing and associated testing	—	X

Table 2. Factory-installed vs. factory-commissioned (continued)

	Factory-installed	Factory-commissioned
Minimum and Maximum airflows settings (occupied/unoccupied)	—	X
Minimum and Maximum temperature setpoints (occupied/unoccupied)	—	X
Minimum ventilation requirements	—	X
Heating offset	—	X
Trane Air-Fi® wireless communications modules (WCI)	X	X
Trane Air-Fi® Wireless Communications Sensor (WCS)	—	—

Trane VAV Systems – VariTrane DDC Controls

VariTrane™ DDC controls simplify control strategies by pre-engineering control logic and sequencing into the controller. This information is available via a twisted-shielded wire pair or wireless communication, and accessible via a Trane Tracer® SC.

Optimized system control strategies, such as ventilation optimization, fan-pressure optimization, and optimal start/stop, are pre-engineered in VariTrane unit-level DDC controllers and the Tracer SC building automation system.

This allows a Trane VAV system to meet or exceed the latest ASHRAE 90.1 Energy Efficiency standards. Pre-engineered controls allow consistent, high quality installations.

Purchasing VAV controllers and VAV hardware from a single manufacturer provides a single contact for all HVAC system related questions.

Application Considerations

VAV Terminal Unit Types

Parallel Fan-Powered

Parallel fan-powered units are commonly used in zones which require some degree of heat during occupied hours when the primary supply air is cool. The terminal unit fan is in parallel with the central unit fan; no primary air from the central fan passes through the terminal unit fan. The terminal unit fan draws air from the space ceiling plenum.

When no heat is needed, the local parallel fan is off and a backdraft damper on the fan's discharge is closed to prevent cool air entry into the plenum. When cool primary airflow to the zone is at a minimum and the zone temperature drops below heating setpoint, the local parallel fan is turned on and the backdraft damper opens. The fan can deliver either a constant or variable volume of warm plenum air, which is mixed with cool primary air at a minimum flow. Remote heat or terminal reheat can provide additional local heating.

Series Fan-Powered

Series fan-powered terminal units are used commonly in VAV zones that require heat during occupied hours and design higher supply airflows during all conditions. The terminal unit fan is in series with the central fan. Primary air from the central fan always passes through the terminal unit fan.

The local series fan within the terminal unit operates whenever the unit is in the occupied mode. The fan can deliver either a constant or variable volume of air to the zone. As the zone requires less cooling, the primary air damper closes. As the primary air damper closes, the air mixture supplied to the zone contains less cool air and more warm plenum air. Remote heat or terminal reheat can provide additional local heating.

Series fan-powered terminal units are also useful in low supply air temperature systems, since the terminal unit fan can be sized so that warm plenum air is always mixed with low temperature supply air. This raises the supply air temperature to an acceptable distribution level and reduces condensation potential.

For more information, see *VariTrane™ Fan-Powered Series VS*G, LS*F Product Catalog (VAV-PRC017*-EN)*.

Low-Height Fan-Powered

Low-height fan-powered terminal units are a slightly modified version of a fan-powered terminal unit. As its name suggests, the low-height fan-powered unit has a shorter height dimension to accommodate applications where ceiling space is limited. Low acoustic levels are more challenging in these low ceiling space applications due to the reduced radiated ceiling plenum effect.

The operation of the low-height terminal unit is exactly the same as that of a series or parallel terminal unit, as are the options for high-efficiency ECMs, insulation options, etc. As with the other fan-powered terminal units, additional local heating can be provided by remote heat or terminal reheat.

Parallel vs. Series

In many climates, fan-powered systems are a lower operating cost alternative than single-duct systems. The energy inefficiencies inherent in reheating cold primary air can be eliminated with a key design characteristic of fan-powered terminal units, plenum air heating. Heating with warmer plenum air allows for recovery of heat from lighting and other heat sources in the building.

Comparison of Parallel and Series Models

Once it has been determined that a fan-powered system is to be specified, the designer must decide between parallel and series configurations. Each model carries its own characteristics of delivered airflow, energy consumption, and acoustics. For the end user, the designer might consider three goals: a comfortable and productive tenant environment, acceptable installed cost, and low operating costs.

Parallel and series fan-powered terminal units offer specific advantages for particular applications. The table which follows in this section compares the key similarities and differences between the models that the designer should consider in performing an engineering analysis.

Typical Application of Parallel Units

Parallel intermittent fan-powered terminal units are very common in perimeter zones or buildings where loads vary during occupied hours. Core zones, which maintain a more constant cooling requirement, are better suited for variable airflow (single-duct) units. Typical jobs combine parallel fan-powered units (exterior) and single-duct units (interior) to provide an efficient system with lowest first cost. Although the overall NC of parallel systems is lower than an equivalent series system, the intermittent fan is sometimes noticed when energized. To minimize the impact of this NC change, an ECM (Electrically Commutated Motor) can be used which has soft-start technology.

Typical Application of Series Units

Applications requiring constant air movement or blending utilize series constant fan-powered terminal units. Conference rooms, laboratories, and lobbies are common applications. Because the series fan also adds to the system external static pressure, office buildings take advantage of this design feature and down size main air handling equipment. Finally, series terminals are used in low-temperature air systems to temper cold primary air with warm plenum air and deliver it to the zone.

Table 3. Parallel vs. series

	Parallel	Series
Fan Operation	Intermittent operation during occupied and unoccupied modes.	Continuous operation during the occupied modes. Intermittent operation during unoccupied mode.
Operating Sequence	Variable-volume, constant-temperature device during cooling. Constant-volume, variable-temperature during heating.	Constant-volume, variable-temperature device at all times. Delivers design airflow regardless of the load.
Fan Energization	Based on zone temperature deviation from setpoint. No interlock with central system fan required.	Interlocked with central system fan to deliver required air to the zone in both heating and cooling modes.
Terminal Fan Operating and Size	Fan runs during heating load. Size for design heating load. Typically this is 40 to 60% of design primary cooling airflow.	Fan runs continually. Fan sizing should meet the greater of design cooling or heating airflow to the zone.
Air valve Sizing	Design cooling airflow.	Design cooling airflow.
Minimum Inlet Static Pressure Required for Central Fan Sizing	Sufficient to overcome unit, heating coil, downstream duct and diffuser pressure losses.	Sufficient to overcome air valve pressure loss only.
Acoustics	When operating under cooling loads the terminal fan does not run, offering superior acoustic performance similar to single-duct VAV. Under heating loads, the fan operates intermittently. Acoustical impact can be minimized by use of a ECM.	Produces slightly higher background sound pressure levels in the occupied space. This sound level remains constant and is less noticeable than intermittent fan operation with PSC motors.

Figure 7. Series fan-powered terminal

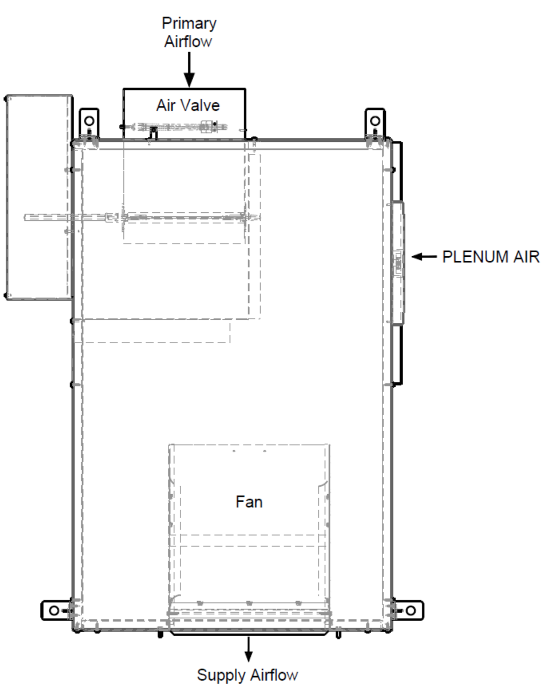
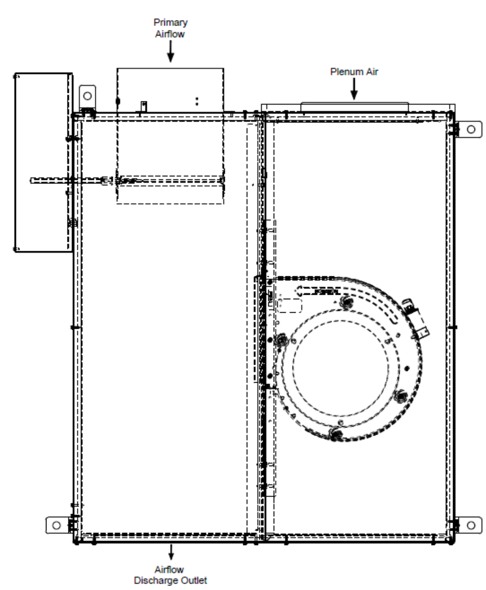


Figure 8. Parallel fan-powered terminal



Energy Savings

Electrically Commutated Motor

The optional ECM provides an additional energy-saving option to the system designer. Some of the advantages of the motor include high efficiency, variable-speed operation, quiet operation, short payback, and easy installation. There are several considerations that need to be addressed when deciding whether to use these motors or not. The primary benefit may be seen as increased efficiency.

Operating Hours – The added cost of an ECM can be offset more quickly in applications which require a relatively high number of hours of operation. However, if a space does not require extensive running time for the unit fan, then it may not be a good candidate for this type of motor based solely on payback. Therefore, the decision about using the ECM may be based on other benefits, depending on the needs of the customer.

Airflow Flexibility – The ECM allows a greater airflow range per fan size. If a space is going to change uses and load components frequently, the ability to change supply airflow with the ECM without changing units will be a benefit.

Airflow Balancing – The ability of the ECM motor to self-balance to an airflow regardless of pressure can be an asset when trying to air balance a job. This will help eliminate additional dampers or changes to downstream ductwork to ensure proper airflow. For more information, please contact your local Trane sales engineer.

Flow Measurement and Control

One of the most important characteristics of a VAV terminal unit is its ability to accurately sense and control airflow. The VariTrane™ terminal unit was developed with exactly that goal in mind. The patented, multiple-point, averaging flow ring measures the velocity of the air at the unit primary air inlet.

The differential pressure signal output of the flow ring provides the terminal unit controller a measurement of the primary airflow through the inlet. The terminal unit controller then opens or closes the inlet damper to maintain the controller airflow setpoint.

Flow Measurement

Most of these terminal units contain a differential pressure airflow measurement device, mounted at the primary air inlet, to provide a signal to the terminal unit controller. Numerous names exist for the differential pressure measurement device-flow sensor, flow bar, flow ring. The differential pressure measured at the inlet varies according to the volumetric flow rate of primary air entering the inlet.

The total pressure and the static pressure are measurable quantities. The flow measurement device in a VAV terminal unit is designed to measure velocity pressure. Most flow sensors consist of a hollow piece of tubing with orifices in it. The VariTrane air valve contains a flow ring as its flow measuring device. The flow ring is two round coils of tubing. Evenly spaced orifices in the upstream coil are the high-pressure taps that average the total pressure of air flowing through the air valve. The orifices in the downstream ring are low-pressure taps that average the air pressure in the wake of flow around the tube. By definition, the measurement of static pressure is to occur at a point perpendicular to the airflow. The low-pressure taps on the VariTrane flow ring measure a pressure that is parallel to the direction of flow but in the opposite direction of the flow. This **wake pressure** that the downstream ring measures is lower than the actual duct static pressure. The difference between the **wake pressure** and the static pressure can be accounted for so that the above relationship between flow and differential pressure remain valid. The difference also helps create a larger pressure differential than the velocity pressure. Since the pressures being measured in VAV terminal unit applications are small, this larger differential allows transducers and controllers to measure and control at lower flow settings than would otherwise be possible.

The average velocity of air traveling through the inlet is expressed in the equation:

$$\text{FPM} = 1096.5\sqrt{\frac{\text{VP}}{\text{DENS}}}$$

Where:

- FPM = Velocity of air in feet per minute
- 1096.5 = A constant
- VP = The velocity pressure of the air expressed in inches of water
- DENS = The density of the air expressed in pounds per cubic foot

Often, the density is assumed to be a constant for dry air at standard conditions [68°F (20°C)] and sea level pressure of 14.7 psi (101.4 kPa). These conditions yield the following commonly used equation:

$$\text{FPM} = 4005\sqrt{\text{VP}}$$

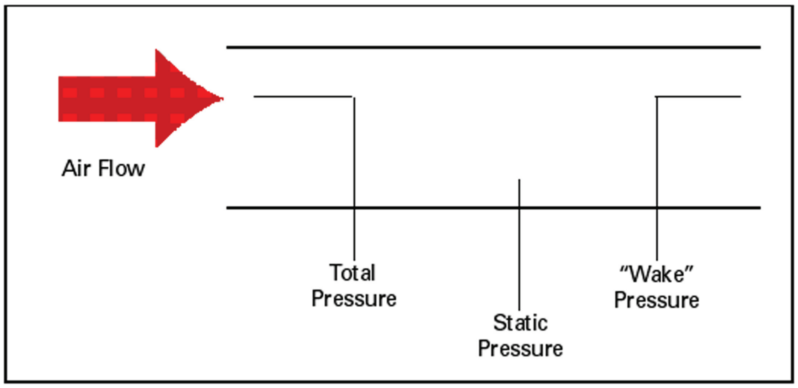
The amount of air traveling through the inlet is related to the area of the inlet and the velocity of the air:

AIRFLOW (cubic feet per minute, cfm) = AREA (square feet) x AVERAGE VELOCITY (feet per minute)

Accuracy

The multiple, evenly spaced orifices in the flow ring of the VariTrane terminal unit provide quality measurement accuracy even if ductwork turns or variations are present before the unit inlet. For the most accurate readings, a minimum of 1-1/2 diameters, and preferably three diameters, of straight-run ductwork is recommended prior to the inlet connection. The straight-run ductwork should be of the same diameter as the air valve inlet connection. If these recommendations are followed, and the air density effects mentioned below are addressed, the flow ring will measure primary airflow within ±5% of unit nominal airflow.

Figure 9. Air pressure measurement orientations



Air Density Effects

Changes in air density due to the conditions listed below sometimes create situations where the standard flow sensing calibration parameters must be modified. These factors must be accounted for to achieve accuracy with the flow sensing ring. Designers, installers, and air balancers should be aware of these factors and know of the necessary adjustments to correct for them.

Elevation

At high elevations the air is less dense. Therefore, when measuring the same differential pressure at elevation versus sea level the actual flow will be greater at elevation than it would be at sea level. To calculate the density at an elevation other than standard conditions (most manufacturers choose sea level as the point for their standard conditions), you must set up a ratio between the density and differential pressure at standard conditions and the density and differential pressure at the new elevation.

$$\frac{\Delta P \text{ Standard Conditions}}{\text{DENS Standard Conditions}} = \frac{\Delta P \text{ New Conditions}}{\text{DENS New Conditions}}$$

Since the data from the manufacturer is published at standard conditions, this equation should be solved for the differential pressure at standard conditions and the other quantities substituted to determine the ratio for the differential pressure measured at the new conditions. For more application consideration information, reference *Applications Engineering Manual, Rooftop VAV Systems* (SYS-APM007*-EN).

Reheat Options

Hot Water Heating Coil

Hot water heating coils are generally applied on VAV terminal units as reheat devices. When applying these coils it is important to confirm they are operating in the proper air flow and water flow range. See "Performance Data," p. 30. Either a two-way or a three-way valve controls the coils.

The most important factor when sizing valves is the coefficient of velocity or C_V. This coefficient of velocity, which is commonly called the flow coefficient, is an industry standard rating. Valves having the same flow coefficient rating, regardless of manufacturer, will have the same waterside performance characteristics.

The preferred method is to size the valve for 3 to 5 psi for pressure drop when full open. Generally the rule of thumb is to use 4 psi.

*C_V = GPM / 2 or GPM = 2 * C_V (since square root of 4 = 2)*.

This formula is very easy to use and is as accurate as any other method. Size the valve for a C_V = 1/2 the GPM it must pass in modulating applications

The equation that governs valve sizing is:

$$C_V = \frac{GPM}{\sqrt{\Delta P}}$$

Where

- C_V = Flow coefficient
- GPM = The maximum water flow rate through the valve in gallons per minute
- ΔP = The maximum allowable differential pressure across the valve in psi

The flow and differential pressure are generally the known quantities. The equation is solved for the flow coefficient. The flow coefficient is then compared to the published C_V values for the control valves that are available. The control valve with the C_V that is the closest, but greater than, the calculated flow coefficient is the correct choice for the control valve. This choice will keep the valve pressure drop below the maximum allowable valve pressure drop. The valve pressure drop should then be checked against the coil pressure drop. If the coil pressure drop is appreciably larger than the valve pressure drop, a valve with a smaller C_V should be selected to produce a larger control valve pressure drop. If this new valve has a pressure drop that is much larger than the maximum allowable pressure drop for valves, the system designer should be consulted to make sure that the system hot water pumps can deliver the water at the new conditions.

Electric Reheat

Electric heating coils are applied on VAV terminal units as terminal reheat devices. Electric heat coil capacity is rated in kilowatts (kW). Coils are available with the total capacity divided into one, two, or three stages

Electric heat coils are available in single-phase or three-phase models. This refers to the type of power source connected to the coil. Single-phase models have resistance elements internally connected in parallel. Three- phase models have resistance elements internally connected in a delta or a wye configuration.

The current draw for the electric coil will depend upon whether it is a single-phase or three-phase coil. The current draw is necessary for determining what size wire should be used to power the electric coil and how big the primary power fusing should be. The equations for current draw for these coils are:

$$1\phi amps = \frac{kW \times 1000}{Primary Voltage}$$

$$3\phi amps = \frac{kW \times 1000}{Primary Voltage \sqrt{3}}$$

VariTrane™ three-phase electric heat is available in balanced configurations. For example, a 9 kW three-phase coil, each stage would carry 1/3 or 3 kW of the load.

It is important to note that these coils have certain minimum airflow rates for each amount of kW heat the coil can supply to operate safely. These airflow values are based upon a maximum rise across the electric heater of 50°F (28°C).

The equation that relates the airflow across an electric coil to the temperature rise and the coil change in temperature is:

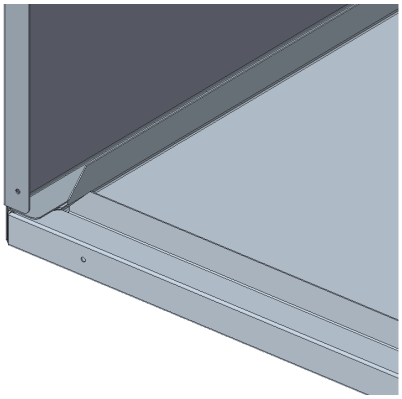
$$CFM = \frac{kW \times 3145}{\Delta T}$$

Where

- CFM = Minimum airflow rate across the coil
- kW = The heating capacity of the electric coil
- 3145 = a constant
- ΔT = The maximum rise in air temperature across the coil, usually 50°F (28°C)

Electric heat coils are available with magnetic or solid state relays. Magnetic contactors are less expensive than solid state relay contactors. However, solid state relay contactors can be cycled at a more rapid rate without failing.

Insulation



Insulation in a VariTrane™ terminal unit is used to avoid condensation on the outside of the unit, to reduce the heat transfer from the cold primary air entering the unit, and to reduce the unit noise. The VariTrane™ line offers four types of unit insulation. The type of facing classifies the types of insulation. To enhance IAQ effectiveness, edges of all insulation types have metal encapsulated edges.

Acoustics

Acoustical Best Practices

Lower velocities within a unit lead to improved acoustical performance. If the VAV terminal unit has a fan, lower RPM provides better acoustical performance.

Sizing of Units

Before blindly increasing the size of units, we must first understand what is setting the acoustics within the space. In general, over 95% of acoustics in VAV terminal units, which set the sound pressure levels and ultimately the NC within the space, is from radiated sound. This is readily known for fan-powered units, but less commonly known for single- and dual-duct units. Radiated sound emanates from the unit and enters the occupied space via means other than through the supply ductwork. The most typical path is through the plenum space, then through the ceiling, then into the occupied space. While discharge sound should never be ignored, radiated sound is the most dominant and usually the most critical sound source.

When increasing air valve sizes, BE CAREFUL. Oversizing an air valve can adversely impact the ability to modulate and properly control temperature in the space. In extremely oversized situations, the air valve will operate like a two-position controlled device, with air either being on, or off, and not much in between. The best way to avoid this is to understand that the minimum air velocity for most air valves is 300 FPM. This is a function of the flow sensing device and the ability of the pressure transducer and controller to properly read and report flow. This is not manufacturer specific, as physics applies to all. When sizing air valves, minimum velocity for proper pressure independent flow is 300 FPM.

Modulation capability and range is vital for proper operation of VAV systems. A good rule of thumb is to size design cooling airflow for a maximum of 2000 FPM. VAV systems only operate at full flow when there is a maximum call for cooling in the zone. The majority of the time, the air valve will be operating at partial flow.

When sizing fan-powered units, the fan airflow range can be determined by looking at the fan-curve. For parallel and series fan-powered units that operate at a constant fan speed, selections can be made all the way to the lowest flow ranges of the fan curve. A good balance of performance and cost is to select fans at 70-80% of maximum fan flow.

Insulation Types

Insulation is a factor to consider when dealing with the acoustics of terminal units. Most insulation types will provide similar acoustical results, but there are exceptions. Double-wall and closed-cell foam insulation will generally increase your sound levels because of the increased reflective surface area that the solid inner-wall and closed-cell construction provides. This increase in sound will have to be balanced with the IAQ and cleanability considerations of the dual-wall and closed-cell construction.

Acoustics – Series vs. Parallel Fan Units

Acoustical considerations may affect whether a series or parallel fan-powered terminal unit is selected.

The parallel unit has the advantage of fan energization and fan acoustical impact only when heating is needed. Parallel fans are smaller than series units because they are typically sized for 30 to 60% of total unit flow. The disadvantage of the parallel unit is intermittent sound. This impact can be minimized by using an ECM, which has slow fan ramp-up speed and can be configured for variable-speed fan control.

The primary acoustic benefit of a series fan-powered unit configured for constant-speed fan control is that the fan runs at the same speed continuously. Sometimes the unit can be selected at slightly higher sound levels due to the constant nature of the sound.

The primary acoustic disadvantage of the series unit is the need to size the unit fan for the total room airflow.

Note: *Operating parallel units with a continuously operating fan may be considered for some applications. This provides the quietest overall fan-powered system with the benefit of continuous fan operation. See your local Trane sales engineer for more details.*

Placement of Units

Unit placement in a building can have a significant impact on the acceptable sound levels. Locating units above non-critical spaces (hallways, closets, and storerooms) will help to contain radiated sound from entering the critical occupied zones.

Unit Attenuation

Factory installed suppressor attenuators are an option available to provide path sound attenuation. Manufacturer-provided attenuators on the discharge of a terminal unit are targeted at reducing discharge path noise and are typically a simple lined piece of ductwork. The downstream ductwork design should be slightly longer and include lining. Attenuators on the plenum inlet of fan-powered terminals are targeted at reducing radiated path noise since the plenum opening on a fan-powered terminal unit is typically the critical path sound source. Significant reduction in radiated path noise can result from a well-designed inlet attenuator. The attenuation from these attenuators is due to simple absorption from the attenuator lining and occupant line of sight sound path obstruction. Longer attenuators and attenuators that require the sound to turn multiple corners before reaching the occupied space provide superior results, particularly in the lower frequency bands.

Table 4. Octave band frequencies

Octave Band	Center Frequency	Band Edge Frequencies
1	63	44.6-88.5
2	125	88.5-177
3	250	177-354
4	500	354-707
5	1000	707-1414
6	2000	1414-2830
7	4000	2830-5650
8	8000	5650-11300

Certification and Testing

Terminal units should be submitted based on the same criteria. There are several ways to ensure this by certification and testing.

Raw unit sound data can be good measurement criteria for evaluation. In using this as a basis for comparison, the designer needs to make sure that the information is based on the AHRI Standard 880-2017 that gives the procedure for testing.

Specifying NC or RC sound levels is a possible comparison, but the designer needs to be sure the comparison is based on the same standards. Two options are: specify the attenuation effect on which you would like the units to be evaluated or specify that AHRI Standard 885-2008 transfer functions be used. AHRI Standard 885-2008 is the first AHRI Standard that specifies exact transfer functions to be used for evaluation. Previous versions of the standard gave guidelines, but manufacturers could choose their own set of factors.

Path Attenuation

Sound generated by a terminal unit can reach the occupied space along several paths. The terminal unit generated sound will lose energy – i.e. the energy is absorbed by path obstacles – as it travels to the occupied space. This acoustical energy dissipation as it travels to the occupied space is called path attenuation. The amount of energy lost along a particular path can be quantified and predicted using the procedure outlined in AHRI-885. Each path must be considered when determining acceptable sound power generated by a terminal unit.

Transfer function is often used to describe the entire path attenuation value for each octave band (i.e., the sum of all components of a particular path).

Examples of path attenuation include locating the terminal unit away from the occupied space, increasing the STC (sound transmission classification) of the ceiling tile used, internally lining ductwork, drywall lagging the ceiling tiles or enclosing the terminal unit in drywall. All of these choices have costs associated with them that must be weighed against the benefits. Some of these alternatives can be acoustically evaluated from application data provided in AHRI-885. Others may require professional analysis from an acoustical consultant.

Computer Modeling

Computer modeling of acoustical paths is available to help estimate sound levels and determine problem sources. The software used by Trane for computer modeling is called Trane Acoustics Program (TAP™).

This software can analyze different room configurations and materials to quickly determine the estimated total sound levels (radiated and discharged) in a space. Trane Select Assist™ can also be used to determine sound levels of terminal units. You can base selections on a maximum sound level and enter your own attenuation factors (defaults based on AHRI-885 are also available).

Best Practices

Common Mistakes

Some of the most common system or installation errors are discussed below.

Reducers at Unit Inlet

This problem is a very common issue that is seen in applications of VAV products. It is often mistaken by those in the field as an unacceptably large static pressure drop through the unit. It is also sometimes mistaken as a malfunctioning flow ring or pressure transducer.

This problem is sometimes unknowingly encountered because of the capability of the VAV unit to allow greater airflow for a specific size duct than other terminal units. For example, a project engineer specifies an 8-inch (203 mm) round take off from the main duct trunk to the VAV terminal unit. The person supplying the VAV terminal unit checks the required airflow and finds that a VAV unit with a 6-inch (152 mm) inlet will provide the specified terminal unit performance. The terminal unit supplier submits, receives approval, and orders the 6-inch (152 mm) inlet unit. While this is happening, the installing contractor has run the connecting duct from the main trunk to the terminal unit in the specified 8-inch (152 mm) round. The unit arrives at the job site, and the installer notices that the 8-inch (203 mm) duct and the 6–inch (152 mm) terminal unit inlet do not match. To get the unit installed, an 8- to 6-inch reducer is placed at the inlet to the terminal unit air valve.

The reducer will cause a phenomenon called flow separation at the unit inlet. Fluid dynamics analysis can present a detailed technical explanation of flow separation, but the characteristics important to this discussion are the production of pressure loss and turbulence. The reducer will have a significant static pressure drop associated with it since the air velocity is increased (i.e., static pressure is given up for increased velocity pressure). The pressure loss is sometimes mistaken as a loss due to the function of the terminal unit. The turbulence is at its greatest just downstream of the reducer. Unfortunately, this is the location of the flow ring at the air-valve inlet. The reducer will cause the flow ring to give an inaccurate and inconsistent reading because of the turbulent air.

The solutions to this situation are:

- Locate the reducer upstream of the terminal unit at least three duct diameters to eliminate flow separation and turbulence at the unit inlet and to improve the airflow measurement accuracy.
- Consider proper sizing of the terminal unit in the duct design and account for the pressure loss of the reducer in the central fan selection if a reducer is required. Be cautious of oversizing a VAV terminal. It is good practice to make sure that the inlet duct velocity at the minimum airflow setting is no lower than 500 feet per minute.

Improper Use of Flexible Ductwork

While flexible ductwork has many benefits, improper use can cause numerous problems in a VAV system. Flexible ductwork causes turbulent airflow and relatively large static pressure drops. Flexible ductwork at a primary damper inlet (i.e., the flow sensor location) may cause flow accuracy and repeatability problems due to turbulence. The use of flexible ductwork should be primarily limited to the downstream side of the terminal units in a VAV system. Use of flexible ductwork upstream of terminal units should be kept to an absolute minimum. All runs of flexible ductwork should be kept as short as possible. While most know these guidelines, the ease of installation which flexible ductwork provides is always an enticement to push the limits of what are acceptable practices.

Static Pressure Measurement Errors

Improper measurement techniques for static pressure can lead many to mistakenly believe that the terminal unit is causing a large pressure drop in the system. The chief error made here is taking a static pressure measurement in turbulent locations such as flexible ductwork or near transitions. This produces invalid static pressure readings. Another error commonly made is trying to read the static pressure at the same point as the flow sensing device. The inlets to VAV terminal units produce turbulence and will give poor readings. Flow sensors with their multiple-point averaging capability are best equipped to deal with this type of flow, while a single-point static probe is not. Another common error is the incorrect orientation of the static pressure probe. The static pressure is correctly measured when the probe is oriented perpendicular to the direction of airflow. The probe, or a part of it, should never be facing the direction of airflow, because the total pressure will influence the reading of the probe.

VAV System and Product References

VAV System	Product Reference
VAV Systems Air Conditioning Clinic	TRG-TRC014*-EN
Trane Intelligent VAV Systems	APP-PRC010*-EN
Chilled-water VAV Systems Applications Engineering Manual	SYS-APM008*-EN
Acoustics in Air Conditioning Applications Engineering Manual	ISS-APM001*-EN

Selection Procedure

This section describes elements and process required to properly select fan-powered VAV terminals and includes a specific examples. Selection procedure is iterative in nature, which makes computer selection desirable. Selection of fan-powered VAV terminals involves four elements:

- Air valve selection
- Heating coil selection
- Fan size and selection
- Acoustics

Note: *Use the same selection procedures and elements for selecting Low-Height Fan-Powered Units.*

Air Valve Selection

Provided in the Performance Data—Air Pressure Requirements section of the catalog is the unit air pressure drop at varying airflows. To select an air valve, determine the airflow required at design cooling. Next, select an air valve diameter that will allow proper airflow modulation, (a maximum velocity of 1600 – 2000 FPM is recommended). Keep in mind that **modulation below 300 FPM is not recommended.** Proper selection requires defining the minimum valve airflow (in either heating or cooling) and maintaining at least 300 FPM through the air valve. The minimum is typically set based on ventilation requirements. If zone ventilation does not come through the VAV unit, a minimum valve position can also be zero.

Heating Coil Selection

Supply Air Temperature

The first step required when selecting a heating coil is to determine the heating supply air temperature to the space, calculated by using the heat transfer equation. A recommended value is 90°F, although values between 85°F and 95°F are common. Discharge air temperatures that exceed 20 degrees above space temperature are not recommended for proper diffuser operation. Air temperature difference is defined as the heating supply air temperature to the space minus the winter room design temperature. The zone design heat loss rate is denoted by the letter Q. Supply air temperature to the space equals the leaving air temperature (LAT) for the terminal unit.

Coil Leaving Air Temperature

Once the terminal unit LAT is determined, the heating requirements for the coil can be calculated. The leaving air temperature for the coil of a parallel fan-powered terminal unit varies based on the type of unit installed heat being selected.

Electric coil LAT equals terminal unit LAT because the coil is located on the unit discharge. Hot water coils can be located on either the discharge or, for maximum system efficiency, the plenum inlet when located on the entering air side of the fan. Coil LAT is calculated by using a mixing equation. Given the unit heating airflow and LAT, minimum primary airflow at its supply air temperature, and the volume of heated plenum air, the leaving air temperature for the hot water coil can be determined (see the unit selection example that follows for more details).

Coil Entering Air Temperature

The entering air temperature (EAT) to the coil also varies based on the coil position on the unit for parallel units.

Parallel electric coils are mounted on the unit discharge. Hot water coils can be mounted on the discharge or on the plenum inlet. Plenum inlet mounting creates a more efficient VAV system. This is because the parallel fan is energized only when in heating mode, and thus, when in cooling mode, the water coil is not in the air stream.

The EAT for discharge mounted coils equals the temperature of blended primary air and plenum air. For plenum inlet mounted water coils, the EAT equals the plenum air temperature.

Capacity Requirement

Once both coil EAT and LAT are determined, the heat transfer (Q) for the coil must be calculated using the heat transfer equation. For electric heat units, the Q value must be converted from Btu to kW for heater selection. The required kW should be compared to availability charts in the performance data section for the unit selected. For hot water heat units, reference the capacity charts in the performance data section for the required heat transfer Q and airflow to pick the appropriate coil.

Fan Size and Selection

Fan Airflow

Fan airflow is determined by calculating the difference between the unit design heating airflow and minimum primary airflow.

Fan External Static Pressure

Fan external static pressure is the total resistance experienced by the fan, which may include downstream ductwork and diffusers, heating coils, and sound attenuators. As total airflow varies so will static pressure, making calculation of external static pressure dependent on unit type.

In many applications of parallel terminals, a minimum primary airflow must be maintained to meet ventilation requirements. This primary airflow contributes to the total resistance experienced by the fan and should be accounted for in all components downstream of the fan itself, including electric coils. Hot water coils positioned on the fan inlet are not affected by the additional primary airflow. The static pressure resistance experienced by the fan due to the hot water coil is based on fan airflow only, not the total heating airflow.

Fan Motor Type

The fan motor type that will be used for the unit will need to be known before fan selection can begin. The ECM motor offers more efficient operation than the standard single-speed PSC motor and will use different fan curves. Refer to “,”, to determine which motor is more appropriate for the unit

Selection

Once fan airflow and external static pressure are determined, reference the fan curves in the performance data section. Cross plot both airflow and external static pressure on each applicable graph. A selection between the minimum and maximum airflow ranges for the fan is required.

It is common to identify more than one fan that can meet the design requirements. Typically, selection begins with the smallest fan available to meet capacity. If this selection does not meet acoustical requirements, upsizing the fan and operating it at a slower speed can be done for quieter operation.

Acoustics

Air Valve Generated Noise

To determine the noise generated by the air valve, two pieces of information are required; design airflow and design air pressure drop. The design air pressure drop is determined by taking the difference between design inlet and static pressure (the valve’s most over-pressurized condition) and external static pressure at design cooling flow. This represents a worst-case operating condition for the valve.

Fan Generated Noise

To determine fan noise levels, fan airflow, external static pressure and speed information is required.

Evaluation Elements

For parallel fan-powered terminal units, the air valve and fan operation must be evaluated separately because these operations are not simultaneous. Access the appropriate acoustics table(s) of the catalog and determine the sound power and NC prediction for both the discharge and radiated paths. It is important to understand that discharge air noise is generally not a concern with fan-powered terminals. Radiated noise from the unit casing typically dictates the noise level of the space. If the entire unit or any element of it is generating noise in excess of the noise criteria requirements, the size of the appropriate portion of the terminal should be increased. Because the selection procedure is iterative, care should be taken by the designer to confirm that the change in selection does not affect other elements of the unit or system design.

Selection Example — Parallel With Hot Water Heat

Air Valve Selection

Design cooling airflow: 1000 cfm
Minimum ventilation airflow: 200 cfm
Maximum unit APD: 0.25 in. wg
Choose 10" air valve

Check—Is minimum airflow above 300 FPM

Heating Coil Selection

Required Information:
Zone design heat loss: 20000 Btu/hr
Unit heating airflow: 600 cfm
Winter room design temp.: 68ºF
Coil entering water temp.: 140ºF
Minimum primary airflow: 200 cfm
Fan airflow: 400 cfm
Plenum air temperature: 70ºF
Coil flow rate: 2 gpm
Primary air temperature: 55ºF

Heat Transfer Equation (Btu/hr): Q = 1.085 **×** cfm **×** Temperature Difference

For the heating zone, the cfm is the unit heating airflow, and the temperature difference is the zone supply air temperature (SAT) minus the winter room design temperature.

18000 Btu/hr = 1.085 **×** 600 cfm**×** (SAT - 68ºF)
SAT = 95.6ºF

Because the designer chose to maximize system efficiency by having the hot water coil on the plenum inlet, the unit supply air temperature is equal to the mix of the heated plenum air from the fan and the minimum primary airflow.

600 cfm **×** 95.6ºF = 200 cfm **×** 55ºF + (600 cfm - 200 cfm) **×** Coil LAT

Coil LAT = 116ºF

For the heating coil, the temperature difference is the calculated coil LAT minus the coil EAT (Plenum Air Temperature).
Coil Q = 1.085 **×** 400 cfm **x** (116°F - 70°F) = 19,964 Btu/hr = 19.96 MBh

Coil Performance Table

Selection:

Size small fan, 2-row coil with 2 gpm = 23MBh (at 400 cfm)

2-row coil with 2gpm = 0.28 ft WPD

Fan Selection

Required Information:

Design airflow: 400 cfm
Downstream static pressure at design airflow: 0.25 in. wg

Fan external static pressure equals downstream static pressure (ductwork and diffusers) plus coil static pressure. The coil static pressure that the fan experiences is at the fan airflow (400 cfm). The downstream static pressure the fan experiences is at fan airflow plus minimum primary airflow. The sum of fan airflow and minimum primary airflow (600 cfm) is less than design airflow (1000 cfm) and therefore the 0.25 in. wg downstream static pressure at design airflow must be adjusted for the lower heating airflow.

Parallel fan-powered unit with water coil (two options)

Figure 10. Plenum inlet mounted

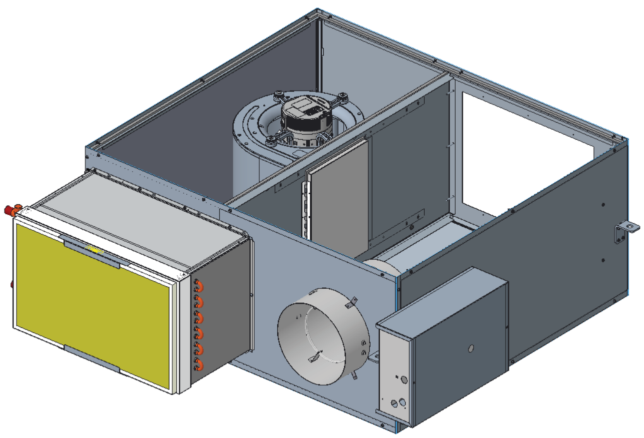
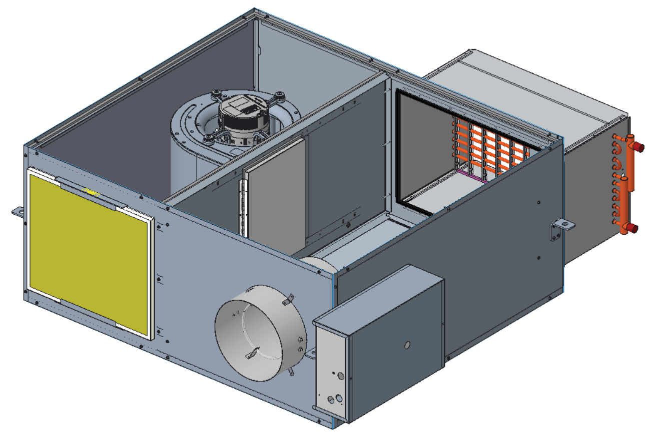


Figure 11. Dicharge mounted



Using fan law two:

Heating downstream static pressure = (600 cfm/1000 cfm) 2 × 0.25 in. wg = 0.09 in. wg

A size Small fan has the capability to deliver approximately 650 cfm at 0.09 downstream static pressure.

Computer Selection

Trane has developed a computer program to schedule, size, and select VAV terminal units. The software is called Trane Select Assist™.

The Trane Select Assist™ program will take the input specifications and output the properly sized VAV™ terminal unit along with the specific performance for that size unit.

The program has several required fields, denoted by red shading in the Trane Select Assist screen, and many other optional fields to meet the criteria you have. Required values include maximum and minimum airflows, control type, and model. If selecting models with reheat, you will be required to enter information to make that selection also. The user is given the option to look at all the information for one selection on one screen or as a schedule with the other VAV units on the job.

User can select single-duct, dual-duct, and fan-powered VAV boxes with the program, as well as most other Trane® products, allowing selection of all Trane equipment with one software program.

The program will also calculate sound power data for the selected terminal unit. The user can enter a maximum individual sound level for each octave band or a maximum NC value. The program will calculate acoustical data subject to default or user supplied sound attenuation data.

Schedule View

The program has many time-saving features such as:

- Copy/paste from spreadsheets like Microsoft® Excel
- Easily arranged fields to match your schedule
- Time-saving templates to store default settings

User can also export Schedule View to Excel to modify and put into a CAD drawing as a schedule.

Specific details regarding program, its operation, and how to obtain a copy of it are available from a local Trane sales office.

Model Number Descriptions

Fan Powered VAV Units – Parallel

Digit 1, 2, 3, 4 — Unit Model

VPCG = Parallel Fan Powered Cooling Only
VPEG = Parallel Fan Powered with Electric Heat
VPWG = Parallel Fan Powered with Hot Water Heat

Digit 5, 6 — Primary Air Valve

05 = 5-in. inlet (350 cfm)
06 = 6-in. inlet (500 cfm)
08 = 8-in. inlet (900 cfm)
10 = 10-in. inlet (1400 cfm)
12 = 12-in. inlet (2000 cfm
14 = 14-in. inlet (3000 cfm)
16 = 16-in. inlet (4000 cfm)

Digit 7, 8 — Secondary Air Valve Used

00 = Not Applicable

Digit 9 — Fan Size

1 = Small
2 = Medium
3 = Large

Digit 10, 11 — Design Sequence

A0 = Design Sequence

Digit 12, 13, 14, 15 — Controls

DD00 = Trane Actuator Only
ENCL = Shaft Only in Enclosure
FM00 = Other Actuator and Control
FM01 = Trane Supplied Actuator, Other Ctrl
SE41 = Symbio™ 500 DDC-Basic (Cooling only)
SE42 = Symbio 500 DDC-Basic (Water heat-N.C. 2-position)
SE43 = Symbio 500 DDC-Basic (Water heat-Modulating)
SE44 = Symbio 500 DDC-Basic (Electric heat-Staged)
SE45 = Symbio 500 DDC-Basic (Electric heat-PWM)
SE47 = Symbio 500 DDC-Basic (Water heat-N.O. 2-position)
SE53 = Symbio 500 DDC-Basic plus Local (Electric heat-pwm) Remote (Staged)
SE54 = Symbio 500 DDC-Basic plus Local (Water heat Modulating) Remote (Water-N.C. 2–position)
SE55 = Symbio 500 DDC-Basic plus Local (Water heat Modulating) Remote (Water-N.O. 2–position)
SE56 = Symbio 500 DDC-Basic plus Local (Water heat N.O. 2-position) Remote (Water-Modulating)
SE57 = Symbio 500 DDC-Basic plus Local (Water heat N.C. 2-position) Remote (Water-Modulating)
SE58 = Symbio 500 DDC-Basic plus Local (Water heat N.O. 2-position) Remote (Water-N.O. 2-position)

Digit 12, 13, 14, 15 — Controls (Continued)

SE59 = Symbio 500 DDC-Basic plus Local (Water heat N.C. 2-position) Remote (Water-N.C. 2-position)
SE60 = Symbio 500 DDC-Basic plus Local (Water heat N.O. 2-position) Remote (Water-N.C. 2-position)
SE61 = Symbio 500 DDC-Basic plus Local (Water heat N.C. 2-position) Remote (Water-N.O. 2-position)
SE62 = Symbio 500 DDC-Basic plus Local (Electric heat-staged) Remote (Staged)
SE65 = Symbio 500 DDC-Control with Modulating SCR
SE66 = Symbio 500 DDC-Space Temp Control with Local SCR and Remote Stage Electric heat
SE71 = Symbio 210e DDC - Basic (Cooling only)
SE72 = Symbio 210e DDC - Basic (Water heat- N. C.- 2 position)
SE73 = Symbio 210e DDC - Basic (Water heat-Modulating)
SE74 = Symbio 210e DDC - Basic (Electric heat-staged)
SE75 = Symbio 210e DDC - Basic (Electric heat-PWM)
SE77 = Symbio 210e DDC -Basic (Water heat -N. O.- 2 position)
SE83 = Symbio 210e DDC- Basic plus- Local (Electric heat- PWM) Remote (Staged)
SE84 = Symbio 210e DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.C. 2-position)
SE85 = Symbio 210e DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.O. 2-position)
SE86 = Symbio 210e DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water-Modulating)
SE87 = Symbio 210e DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water-Modulating)
SE88 = Symbio 210e DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.O. 2-position)
SE89 = Symbio 210e DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.C. 2-position)
SE90 = Symbio 210e DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.C. 2-position)
SE91 = Symbio 210e DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.O. 2-position)
SE92 = Symbio 210e DDC- Basic plus- Local (Electric heat- Staged) Remote (Staged)
SE95 = Symbio 210e DDC - Control with Modulating SCR
SE96 = Symbio 210e DDC - Space Temp Control with Local SCR and Remote Staged Electric heat
SY71 = Symbio 210 DDC - Basic (Cooling only)
SY72 = Symbio 210 DDC - Basic (Water heat- N. C.- 2 position)
SY73 = Symbio 210 DDC - Basic (Water heat-Modulating)
SY74 = Symbio 210 DDC - Basic (Electric heat-staged)

Digit 12, 13, 14, 15 — Controls (continued)

SY75 = Symbio 210 DDC - Basic (Electric heat-PWM)
SY77 = Symbio 210 DDC -Basic (Water heat -N.O.- 2 position)
SY83 = Symbio 210 DDC- Basic plus- Local (Electric heat- PWM) Remote (Staged)
SY84 = Symbio 210 DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.C. 2-position)
SY85 = Symbio 210 DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.O. 2-position)
SY86 = Symbio 210 DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- Modulating)
SY87 = Symbio 210 DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- Modulating)
SY88 = Symbio 210 DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.O. 2-position)
SY89 = Symbio 210 DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.C. 2-position)
SY90 = Symbio 210 DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.C. 2-position)
SY91 = Symbio 210 DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.O. 2-position)
SY92 = Symbio 210 DDC- Basic plus- Local (Electric heat- Staged) Remote (Staged)
SY95 = Symbio 210 DDC - Control with Modulating SCR
SY96 = Symbio 210 DDC - Space Temp Control with Local SCR and Remote Staged Electric heat

Digit 16 — Insulation

B = 1-in. Matte-faced
D = 1-in. Foil-faced
F = 1-in. Double Wall
G = 3/8-in. Closed-cell

Digit 17— Motor Type

D = PSC Motor
E = ECM - Constant Volume
F = ECM - Variable Volume

Digit 18 — Motor Voltage

1 = 115/60/1
2 = 277/60/1
4 = 208/60/1
5 = 230/50/1

Digit 19 — Outlet Connection

1 = Flanged Connection VPCG and VPEG
2 = Slip and Drive Connection VPWG

Digit 20 — Attenuator

0 = None

Digit 21 — Hot Water Coil

0 = No Water Coil
1 = 1-Row Discharge Water Coil
2 = 2-Row Discharge Water Coil
3 = 3-Row Discharge Water Coil
4 = 4-Row Discharge Water Coil
A = 1-Row Premium Discharge Water Coil
B = 2-Row Premium Discharge Water Coil
C = 3-Row Premium Discharge Water Coil
D = 4-Row Premium Discharge Water Coil
E = 1-Row Inlet Water Coil
F = 2-Row Inlet Water Coil
G = 3-Row Inlet Water Coil
H = 4-Row Inlet Water Coil
J = 1-Row Premium Inlet Water Coil
K = 2-Row Premium Inlet Water Coil
L = 3-Row Premium Inlet Water Coil
M = 4-Row Premium Inlet Water Coil

Digit 22 — Hot Water Coil Connection (Discharge Only)

1 = Same Side Connection – Coil and Control
2 = Coil Connection Opposite of Control

Digit 23 — Unit Filter

0 = 1-in. Throw Away
8 = 1-in. MERV 8
3 = 2-in. MERV 13
S = Special Filter

Digit 24 — Toggle Switch

0 = With Toggle Switch – VPCG and VPWG
W = Unit Disconnect with Toggle Switch – VPEG

Digit 25 — Power Fuse

0 = No Fusing
W = With Power Fusing

Digit 26 — Electric Heat Voltage

0 = None
A = 208/60/1
B = 208/60/3
C = 240/60/1
D = 277/60/1
E = 480/60/1
F = 480/60/3
J = 380/50/3
K = 120/60/1

Digit 27, 28, 29 — Electric Heat kW

000 = None
010 = 1.0 kW
015 = 1.5 kW
220 = 22.0 kW

Notes:

- *1.0 to 8.0 kW in 1/2 kW increments*
- *8.0 to 18.0 kW in 1 kW increments*
- *18.0 to 22.0 kW in 2 kW increments*

Digit 30 — Electric Heat Stages

0 = None
1 = 1 Stage
2 = 2 Stages Equal

Digit 31 — Electric Heat Contactors

0 = No Contactors
1 = 24V Magnetic Contactor
5 = SCR Heat with Trane Controls
6 = SCR Heat FMTD/ENCL/DD00
7 = Solid State Relay (SSR)
S = Special Electric Heater Control

Digit 32 — Electric Heater Air Flow Switch

0 = No Air Flow Switch
W = With Air Flow Switch

Digit 33 — Not Used

0 = Not Applicable

Digit 34 — Actuator

0 = Standard Actuator – Floating Point
A = Belimo™ Actuator – Floating Point
B = Spring Return Actuator – Normally Open
C = Spring Return Actuator – Normally Closed
G = Trane Analog Actuator – Trane Controls Only

Digit 35 — Wireless Sensors

0 = None
3 = Trane Air-Fi® Wireless Communications Interface

Digit 36 — Factory Attached Field Mounted

0 = None
1 = Factory Terminated/Field Installed DTS
2 = Factory Terminated/Field Installed HW Valve Harness
4 = Factory Terminated and Installed DTS in Plenum
5 = Factory Terminated and Installed – DTS in Plenum plus Factory Terminated/Field Installed HW Valve Harness

Digit 37 — Bottom Access

0 = Standard Top and Bottom Access

Digit 38 — Piping Package

0 = None
C = 2-Way Standard Valve Only, Floating Point Actuator
D = 3-Way Standard Valve Only, Floating Point Actuator
E = 2-Way Standard Valve Piping Package, Floating Point Actuator
F = 3-Way Standard Valve Piping Package, Floating Point Actuator

Digit 38 — Piping Package (continued)

G = 2-Way Belimo Valve Only, Floating Point Actuator
H = 3-Way Belimo Valve Only, Floating Point Actuator
J = 2-Way Belimo Valve Piping Package, Floating Point Actuator
K = 3-Way Belimo Valve Piping Package, Floating Point Actuator
L = 2-Way Belimo Valve Only, Analog Actuator
M = 3-Way Belimo Valve Only, Analog Actuator
N = 2-Way Belimo Valve Piping Package, Analog Actuator
P = 3-Way Belimo Valve Piping Package, Analog Actuator

Digit 39 — Water Valve

0 = None
1 = Trane HW Valve 0.7 Cv
2 = Trane HW Valve 2.7 Cv
5 = Analog HW Valve, Field Provided (Trane Controls only)
6 = Trane HW Valve 1.7 Cv
7 = Trane HW Valve 5.0 Cv
A = Belimo HW Valve, 0.3 Cv
B = Belimo HW Valve, 0.46 Cv
C = Belimo HW Valve, 0.8 Cv
D = Belimo HW Valve, 1.2 Cv
E = Belimo HW Valve, 1.9 Cv
F = Belimo HW Valve, 3.0 Cv
G = Belimo HW Valve, 4.7 Cv

Digit 40 — Flow Rate

0 = None
A = 0.50 gpm (0.03 l/s)
U = 0.75 gpm (0.05 l/s)
B = 1.00 gpm (0.06 l/s)
V = 1.25 gpm (0.08 l/s)
C = 1.50 gpm (0.09 l/s)
W = 1.75 gpm (0.11 l/s)
D = 2.00 gpm (0.13 l/s)
E = 2.50 gpm (0.16 l/s)
F = 3.00 gpm (0.19 l/s)
G = 3.50 gpm (0.22 l/s)
H = 4.00 gpm (0.25 l/s)
J = 4.50 gpm (0.28 l/s)
K = 5.00 gpm (0.32 l/s)
L = 5.50 gpm (0.35 l/s)
M = 6.00 gpm (0.38 l/s)
N = 6.50 gpm (0.41 l/s)
P = 7.00 gpm (0.44 l/s)
Q = 7.50 gpm (0.47 l/s)

Digit 41 — Air Leakage

0 = Standard Air Leakage
1 = Certified Ultra-Low Air Leakage

Fan Powered Low Height VAV Units – Parallel

Digit 1, 2, 3, 4 — Unit Model

LPCF = Low Height Parallel Fan Powered Cooling Only
LPEF = Low Height Parallel Fan Powered with Electric Heat
LPWF = Low Height Parallel Fan Powered with Hot Water

Digit 5, 6 — Primary Air Valve

05 = 5-in. inlet (225 cfm)
06 = 6-in. inlet (500 cfm)
08 = 8-in. inlet (900 cfm)
10 = 10-in. inlet (1400 cfm)
14 = 8-in. x 14-in. inlet (1800 cfm)

Digit 7, 8 — Secondary Air Valve Used

00 = Not Applicable

Digit 9 — Fan

A = DS02 Fan (1300 nom cfm)

Digit 10, 11 — Design Sequence

****** = Factory Assigned

Digit 12, 13, 14, 15 — Controls

DD00 = Trane Actuator Only
ENCL = Shaft Only in Enclosure
FM00 = Other Actuator and Control
FM01 = Trane Supplied Actuator, Other Ctrl
SE41 = Symbio™ 500 DDC-Basic (Cooling only)
SE42 = Symbio 500 DDC-Basic (Water heat-N.C. 2-position)
SE43 = Symbio 500 DDC-Basic (Water heat-Modulating)
SE44 = Symbio 500 DDC-Basic (Electric heat-Staged)
SE45 = Symbio 500 DDC-Basic (Electric heat-PWM)
SE47 = Symbio 500 DDC-Basic (Water heat-N.O. 2-position)
SE53 = Symbio 500 DDC-Basic plus Local (Electric heat-pwm) Remote (Staged)
SE54 = Symbio 500 DDC-Basic plus Local (Water heat Modulating) Remote (Water-N.C. 2–position)
SE55 = Symbio 500 DDC-Basic plus Local (Water heat Modulating) Remote (Water-N.O. 2–position)
SE56 = Symbio 500 DDC-Basic plus Local (Water heat N.O. 2-position) Remote (Water-Modulating)
SE57 = Symbio 500 DDC-Basic plus Local (Water heat N.C. 2-position) Remote (Water-Modulating)
SE58 = Symbio 500 DDC-Basic plus Local (Water heat N.O. 2-position) Remote (Water-N.O. 2-position)

Digit 12, 13, 14, 15 — Controls (Continued)

SE59 = Symbio 500 DDC-Basic plus Local (Water heat N.C. 2-position) Remote (Water-N.C. 2-position)
SE60 = Symbio 500 DDC-Basic plus Local (Water heat N.O. 2-position) Remote (Water-N.C. 2-position)
SE61 = Symbio 500 DDC-Basic plus Local (Water heat N.C. 2-position) Remote (Water-N.O. 2-position)
SE62 = Symbio 500 DDC-Basic plus Local (Electric heat-staged) Remote (Staged)
SE65 = Symbio 500 DDC-Control with Modulating SCR
SE66 = Symbio 500 DDC-Space Temp Control with Local SCR and Remote Stage Electric heat
SE71 = Symbio 210e DDC - Basic (Cooling only)
SE72 = Symbio 210e DDC - Basic (Water heat- N. C.- 2 position)
SE73 = Symbio 210e DDC - Basic (Water heat-Modulating)
SE74 = Symbio 210e DDC - Basic (Electric heat-staged)
SE75 = Symbio 210e DDC - Basic (Electric heat-PWM)
SE77 = Symbio 210e DDC -Basic (Water heat -N. O.- 2 position)
SE83 = Symbio 210e DDC- Basic plus- Local (Electric heat- PWM) Remote (Staged)
SE84 = Symbio 210e DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.C. 2-position)
SE85 = Symbio 210e DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.O. 2-position)
SE86 = Symbio 210e DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water-Modulating)
SE87 = Symbio 210e DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water-Modulating)
SE88 = Symbio 210e DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.O. 2-position)
SE89 = Symbio 210e DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.C. 2-position)
SE90 = Symbio 210e DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.C. 2-position)
SE91 = Symbio 210e DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.O. 2-position)
SE92 = Symbio 210e DDC- Basic plus- Local (Electric heat- Staged) Remote (Staged)
SE95 = Symbio 210e DDC - Control with Modulating SCR
SE96 = Symbio 210e DDC - Space Temp Control with Local SCR and Remote Staged Electric heat
SY71 = Symbio 210 DDC - Basic (Cooling only)
SY72 = Symbio 210 DDC - Basic (Water heat- N. C.- 2 position)

Digit 12, 13, 14, 15 — Controls (continued)

SY73 = Symbio 210 DDC - Basic (Water heat-Modulating)
SY74 = Symbio 210 DDC - Basic (Electric heat-staged)
SY75 = Symbio 210 DDC - Basic (Electric heat-PWM)
SY77 = Symbio 210 DDC -Basic (Water heat -N.O.-2 position)
SY83 = Symbio 210 DDC- Basic plus- Local (Electric heat- PWM) Remote (Staged)
SY84 = Symbio 210 DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.C. 2-position)
SY85 = Symbio 210 DDC- Basic plus- Local (Water heat- Modulating) Remote (Water-N.O. 2-position)
SY86 = Symbio 210 DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- Modulating)
SY87 = Symbio 210 DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- Modulating)
SY88 = Symbio 210 DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.O. 2-position)
SY89 = Symbio 210 DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.C. 2-position)
SY90 = Symbio 210 DDC- Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.C. 2-position)
SY91 = Symbio 210 DDC- Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.O. 2-position)
SY92 = Symbio 210 DDC- Basic plus- Local (Electric heat- Staged) Remote (Staged)
SY95 = Symbio 210 DDC - Control with Modulating SCR
SY96 = Symbio 210 DDC - Space Temp Control with Local SCR and Remote Staged Electric heat

Digit 16 — Insulation

A = 1/2-in. Matte-faced
B = 1-in. Matte-faced
D = 1-in. Foil-faced
F = 1-in. Double Wall
G = 3/8-in. Closed-cell

Digit 17 — Motor Type

E = High-efficiency Electronically Commutated Motor (ECM)
F = Variable Speed High-efficiency Electronically Commutated Motor (ECV)

Digit 18 — Motor Voltage

1 = 115/60/1
2 = 277/60/1
4 = 208/60/1

Digit 19 — Outlet Connection

1 = Flanged

Digit 20 — Attenuator

0 = None
T = Thinline Suppressor

Digit 21 — Water Coil

0 = None
1 = 1-Row, Plenum Inlet Installed
2 = 2-Row, Plenum Inlet Installed
3 = 1-Row, Discharge Installed LH
4 = 1-Row, Discharge Installed RH
5 = 2-Row, Discharge Installed LH
6 = 2-Row, Discharge Installed RH
A = 1-Row Premium, Plenum Inlet Installed
B = 2-Row Premium, Plenum Inlet Installed
C = 1-Row Premium, Hot Coil on Discharge LH
D = 1-Row Premium, Hot Coil on Discharge RH
E = 2-Row Premium, Hot Coil on Discharge LH
F = 2-Row Premium, Hot Coil on Discharge RH

Digit 22 — Electrical Connections

F = Flippable Left and Right Hand

Digit 23 — Transformer

0 = Not Applicable

Digit 24 — Disconnect Switch

0 = None
W = With

Note: *Electric reheat door comes with interlocking power disconnect is standard, cooling only and water reheat Comes with toggle on/off switch.*

Digit 25 — Power Fuse

0 = None
W = With

Digit 26 — Electric Heat Voltage

0 = None
A = 208/60/1
B = 208/60/3
C = 240/60/1
D = 277/60/1
E = 480/60/1
F = 480/60/3
H = 575/60/3
J = 380/50/3

Digit 27, 28, 29 — Electric Heat kW

000 = None
010 = 1.0 kW
015 = 1.5 kW

Notes:

- *0.5 to 8.0 kW in 1/2 kW increments*
- *8.0 to 14.0 kW in 1 kW increments*

Digit 30 — Electric Heat Stages

0 = None
1 = 1 Stage
2 = 2 Stages Equal

Digit 31 — Electric Heat Contactors

0 = None
1 = 24V Magnetic
5 = SCR Heat with Trane Controls
6 = 0 to 10 Vdc SCR Heat; FMTD/ENCL/DD00

Notes: *SCR cannot be selected with the following:*

- *kW>10,208V, 3Ph, Low Height*
- *kW>22,480V, 3Ph, Low Height*
- *Voltage = 575V*

Digit 32 — Air Switch

0 = Not Applicable
W = With

Digit 33 — Not Used

0 = Not Applicable

Digit 34 — Actuator

0 = Standard
A = Belimo™ Actuator
G = Trane Analog Actuator (Trane Controls only)

Digit 35 — Wireless Sensors

0 = None
3 = Trane Air-Fi® Wireless Communications Interface

Note: *All sensors selected in accessories.*

Digit 36 — Pre-wired Factory Solutions

0 = None
1 = Factory Wired Duct Temperature Sensor (DTS)
2 = HW Valve Harness
3 = Both Factory Wired DTS/HW Valve Harness

Digit 37 — Bottom Access

W = Bottom Access

Digit 38 — Piping Package

0 = None
C = 2-Way Standard Valve Only, Floating Point Actuator
D = 3-Way Standard Valve Only, Floating Point Actuator
E = 2-Way Standard Valve Piping Package, Floating Point Actuator
F = 3-Way Standard Valve Piping Package, Floating Point Actuator
G = 2-Way Belimo Valve Only, Floating Point Actuator
H = 3-Way Belimo Valve Only, Floating Point Actuator
J = 2-Way Belimo Valve Piping Package, Floating Point Actuator
K = 3-Way Belimo Valve Piping Package, Floating Point Actuator
L = 2-Way Belimo Valve Only, Analog Actuator
M = 3-Way Belimo Valve Only, Analog Actuator
N = 2-Way Belimo Valve Piping Package, Analog Actuator
P = 3-Way Belimo Valve Piping Package, Analog Actuator

Digit 39 — Water Valve

0 = None
1 = Trane HW Valve 0.7 Cv
2 = Trane HW Valve 2.7 Cv
5 = Analog HW Valve, Field Provided (Trane Controls only)
6 = Trane HW Valve 1.7 Cv
7 = Trane HW Valve 5.0 Cv
A = Belimo HW Valve, 0.3 Cv
B = Belimo HW Valve, 0.46 Cv
C = Belimo HW Valve, 0.8 Cv
D = Belimo HW Valve, 1.2 Cv
E = Belimo HW Valve, 1.9 Cv
F = Belimo HW Valve, 3.0 Cv
G = Belimo HW Valve, 4.7 Cv

Digit 40 — Flow Rate

0 = None
A = 0.5 gpm, 0.03 l/s
B = 1.0 gpm, 0.06 l/s
C = 1.5 gpm, 0.09 l/s
D = 2.0 gpm, 0.13 l/s
E = 2.5 gpm, 0.16 l/s
F = 3.0 gpm, 019 l/s
G = 3.5 gpm, 0.22 l/s
H = 4.0 gpm, 0.25 l/s
J = 4.5 gpm, 0.28 l/s
K = 5.0 gpm, 0.31 l/s
L = 5.5 gpm, 0.35 l/s
M = 6.0 gpm, 0.38 l/s
N = 6.5 gpm, 0.41 l/s
P = 7.0 gpm, 0.44 l/s
Q = 7.5 gpm, 0.47 l/s

Performance Data

Parallel Fan-Powered Terminal Units

Table 5. Primary airflow control factory settings — IP

Air Valve Size (in.)	Maximum Valve Cfm	Maximum Controller Cfm	Minimum Controller Cfm	Constant Volume Cfm
5	350	40-350	0, 40-350	40-350
6	500	60-500	0, 60-500	60-500
8	900	105-900	0, 105-900	105-900
10	1400	165-1400	0, 165-1400	165-1400
12	2000	240-2000	0, 240-2000	240-2000
14	3000	320-3000	0, 320-3000	320-3000
16	4000	420-4000	0, 420-4000	420-4000

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 6. Primary airflow control factory settings — SI

Air Valve Size (in.)	Maximum Valve L/s	Maximum Controller L/s	Minimum Controller L/s	Constant Volume L/s
5	165	19-165	0, 19-350	19-350
6	236	28-236	0, 28-236	28-236
8	425	50-425	0, 50-425	50-425
10	661	77-661	0, 77-661	77-661
12	944	111-944	0, 111-944	111-944
14	1416	151-1416	0, 151-1416	151-1416
16	1888	198-1888	0, 198-1888	198-1888

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 7. Air valve leakage (cfm)

Inlet Size	Pressure (in.wg)									
	0.25	**0.50**	**1.00**	**2.00**	**3.00**	**4.00**	**5.00**	**6.00**	**7.00**	**8.00**
5, 6	0.67	1.24	2.16	3.30	3.95	4.47	5.05	5.74	6.43	6.83
8	0.69	1.29	2.23	3.42	4.08	4.59	5.15	5.82	6.48	6.86
10	0.71	1.33	2.31	3.54	4.22	4.72	5.26	5.91	6.55	6.94
12	0.76	1.42	2.45	3.73	4.42	4.94	5.55	6.28	7.00	7.42
14	0.79	1.46	2.52	3.82	4.52	5.06	5.70	6.48	7.27	7.72
16	0.81	1.51	2.60	3.91	4.61	5.15	5.78	6.53	7.25	7.54

Note: Air valve leakage determined with the air valve fully closed and unit discharge open. A precision low flow oriface upstream of the unit is used to measure the leakage rate as a function of the inlet positive static pressure. Leakage testing conducted in accordance with ASHRAE130-2008.

Table 8. Hot water coil air pressure drop — in. wg (I-P)

Unit Size	Airflow CFM	1-Row	2-Row	3-Row	4-Row
Small	200	0.01	0.02	0.03	0.04
	400	0.03	0.06	0.09	0.12
	600	0.06	0.11	0.17	0.23
	800	0.09	0.18	0.27	0.36
	1000	0.13	0.26	0.39	0.52
Medium	400	0.02	0.04	0.05	0.07
	750	0.05	0.09	0.14	0.19
	1100	0.09	0.17	0.26	0.36
	1450	0.13	0.27	0.42	0.56
	1800	0.19	0.39	0.59	0.80
Large	500	0.02	0.05	0.07	0.10
	1000	0.07	0.14	0.22	0.29
	1500	0.14	0.28	0.42	0.57
	2000	0.23	0.45	0.68	0.91
	2500	0.33	0.66	0.99	1.32

Note: HW coil only pressure drops do not include unit pressure drop.

Table 9. Hot water coil air pressure drop - Pa (SI)

Unit Size	Airflow L/S	1-Row	2-Row	3-Row	4-Row
Small	94.39	2.74	5.22	7.96	10.95
	188.78	7.22	14.43	22.14	29.86
	283.17	13.68	27.62	42.05	56.48
	377.56	21.89	43.79	66.93	90.07
	471.95	31.60	63.44	96.53	130.12
Medium	188.78	4.23	8.96	13.44	18.16
	353.96	11.44	23.14	35.33	47.52
	519.14	21.15	43.04	65.68	88.32
	684.32	33.34	67.92	103.50	139.08
	849.51	48.02	97.28	147.79	198.79
Large	235.97	4.98	12.44	17.42	24.88
	471.95	17.42	34.83	54.74	72.15
	707.92	34.83	69.66	104.50	141.82
	943.89	57.22	111.96	169.18	226.41
	1179.87	82.10	164.21	246.31	328.42

Note: HW coil only pressure drops do not include unit pressure drop.

Figure 12. Performance data fan curves, parallel small — PSC

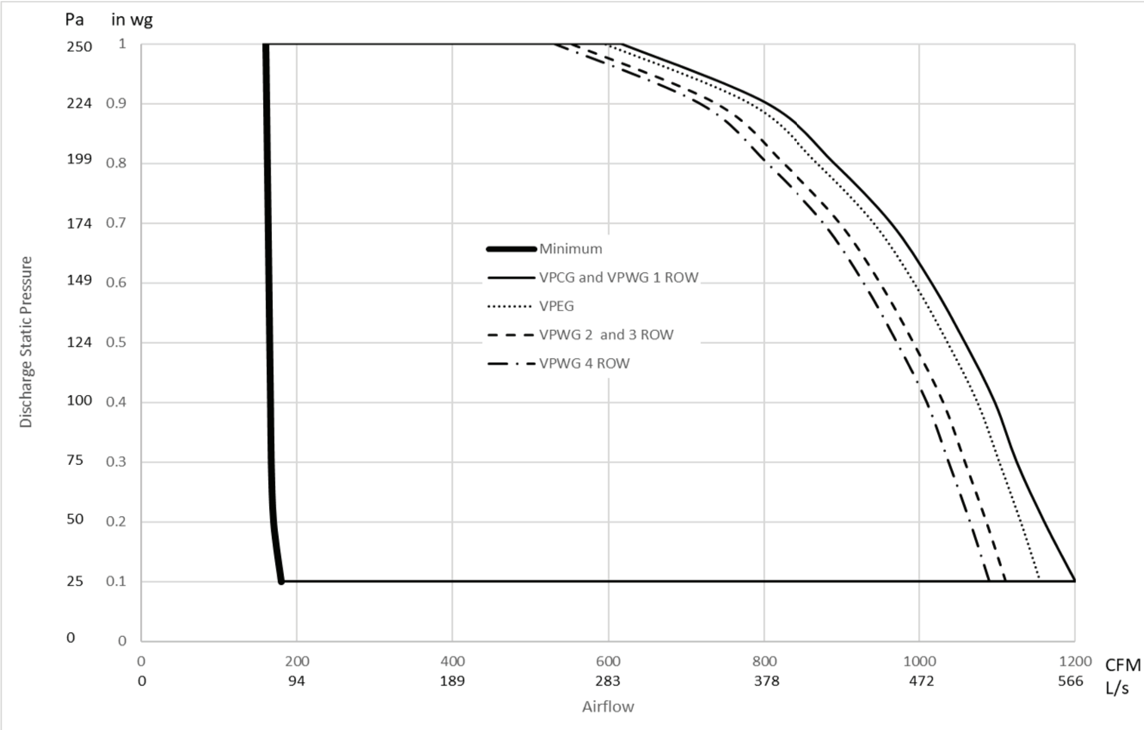


Figure 13. Performance data fan curves, parallel small — ECM

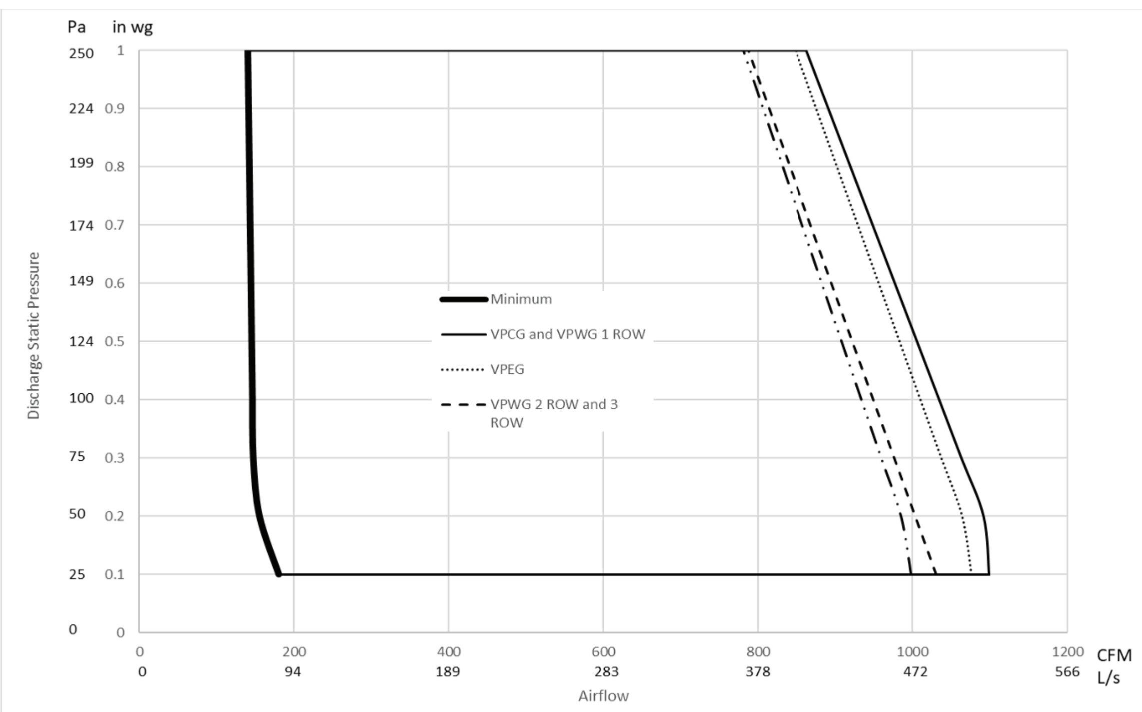


Figure 14. Performance data fan curves, parallel medium — PSC

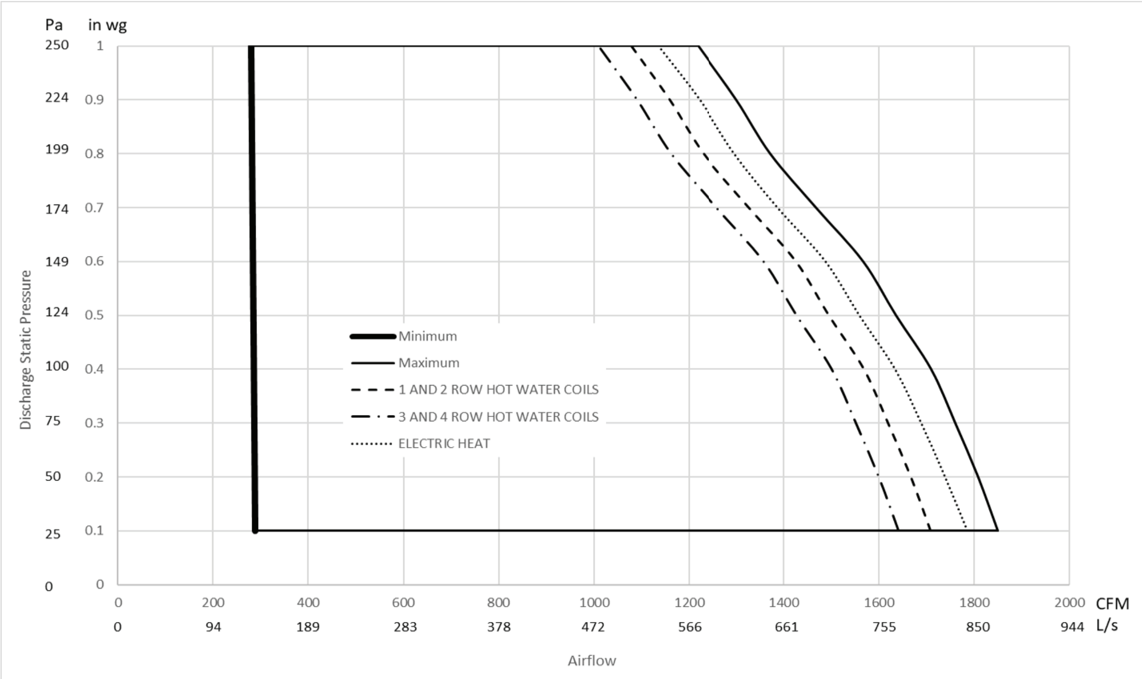


Figure 15. Performance data fan curves, parallel medium — ECM

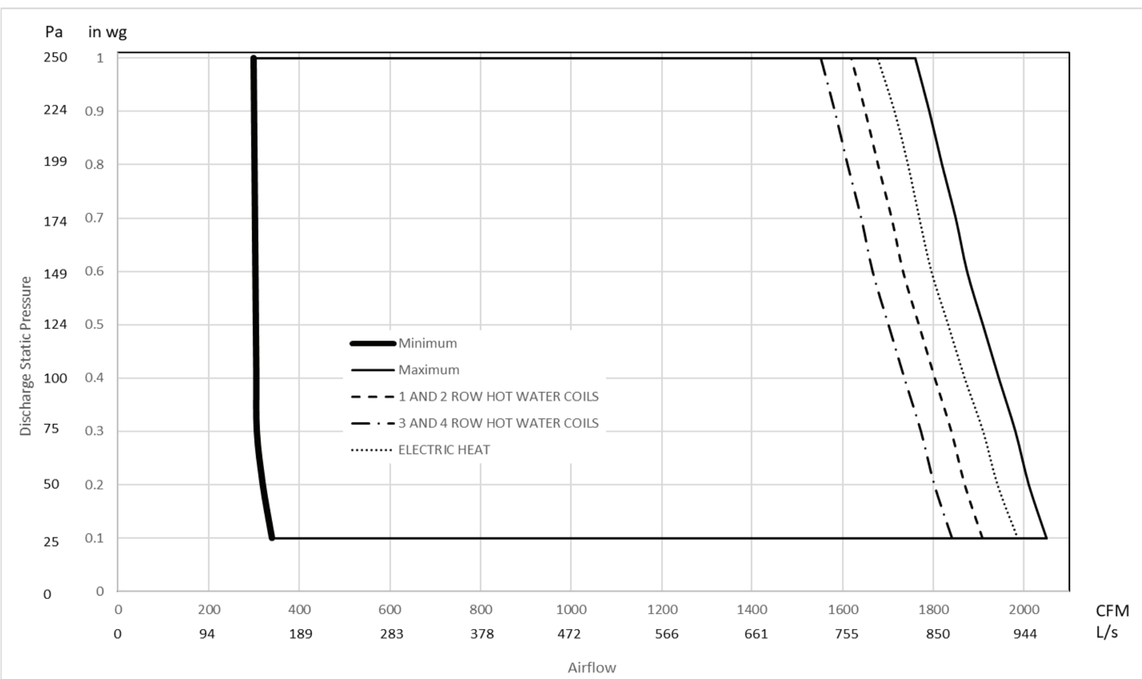


Figure 16. Performance data fan curves, parallel large — PSC

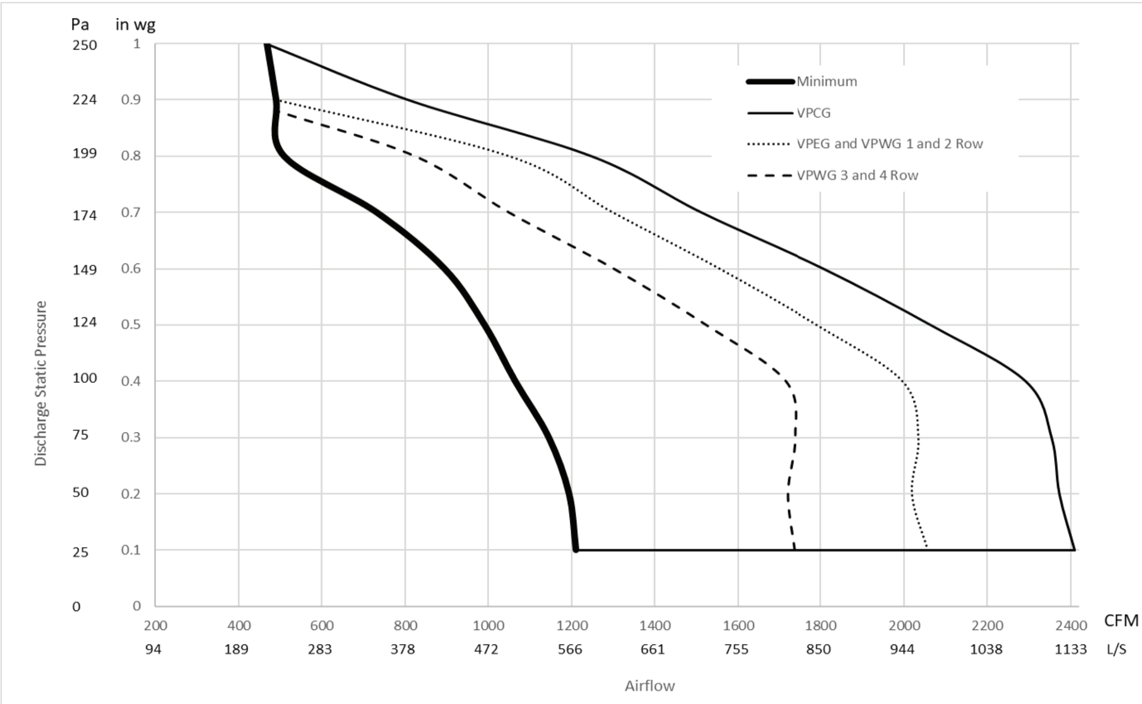


Figure 17. Performance data fan curves, parallel large — ECM

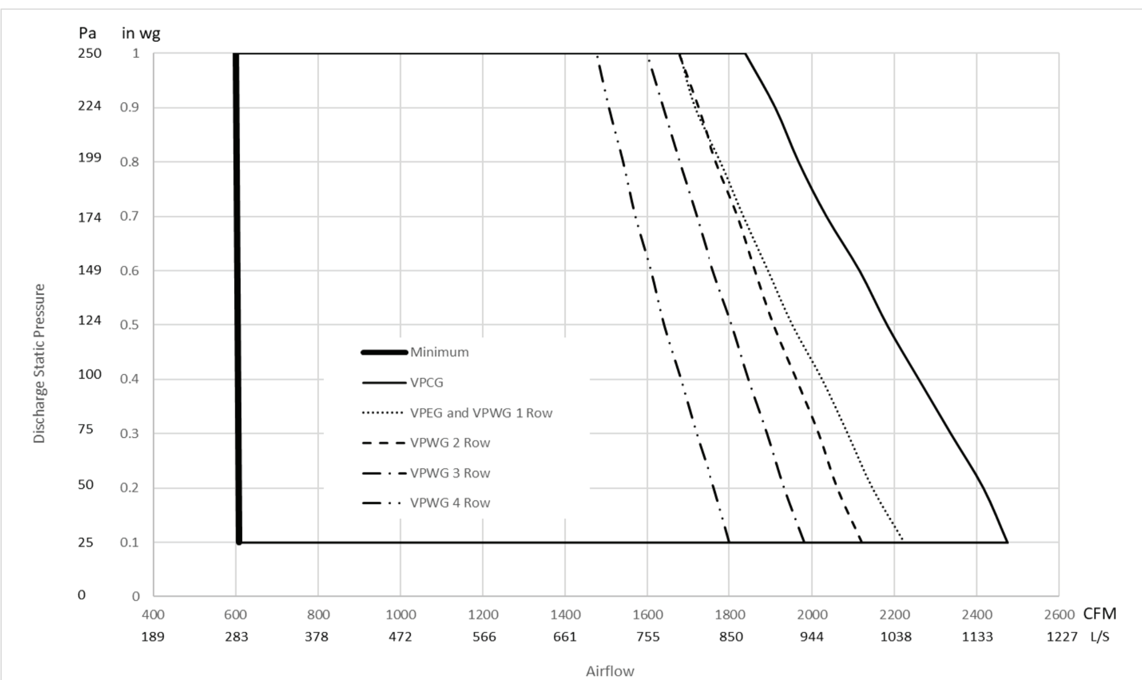


Table 10. Heating capacity (MBh)—Small Fan Size (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (cfm)									
			200	250	300	350	400	500	600	700	800	900
1-Row Capacity MBh	1.0	0.74	11.04	13.41	15.30	16.84	18.13	20.24	21.89	23.18	24.24	25.14
	2.0	2.57	12.04	14.94	17.36	19.43	21.20	24.11	26.42	28.33	29.95	31.39
	3.0	5.37	12.41	15.53	18.18	20.46	22.45	25.77	28.45	30.70	32.65	34.37
	4.0	9.09	12.61	15.84	18.62	21.02	23.14	26.69	29.59	32.04	34.18	36.09
	5.0	13.70	12.73	16.04	18.89	21.38	23.57	27.27	30.32	32.91	35.17	37.20
2-Row Capacity MBh	1.0	0.07	14.65	17.19	19.12	20.63	21.83	23.63	24.90	25.86	26.61	27.22
	2.0	0.26	17.04	20.78	23.93	26.62	28.93	32.67	35.57	37.91	39.84	41.48
	3.0	0.56	17.79	21.95	25.57	28.74	31.54	36.26	40.07	43.24	45.93	48.27
	4.0	0.95	18.16	22.53	26.39	29.82	32.90	38.16	42.51	46.19	49.37	52.18
	5.0	1.45	18.39	22.89	26.90	30.50	33.75	39.38	44.10	48.13	51.65	54.79
3-Row Capacity MBh	1.0	0.10	17.75	20.87	23.30	25.22	26.76	29.03	30.63	31.82	32.75	33.49
	2.0	0.34	20.21	24.68	28.60	32.04	35.05	40.03	43.95	47.10	49.70	51.89
	3.0	0.71	20.90	25.79	30.22	34.23	37.86	44.13	49.33	53.71	57.45	60.70
	4.0	1.21	21.23	26.32	30.98	35.27	39.22	46.19	52.13	57.24	61.69	65.63
	5.0	1.83	21.43	26.63	31.44	35.90	40.04	47.45	53.87	59.47	64.42	68.85
4-Row Capacity MBh	1.0	0.12	19.77	23.33	26.16	28.40	30.20	32.86	34.70	36.04	37.07	37.88
	2.0	0.42	22.02	26.98	31.45	35.45	39.02	45.02	49.79	53.62	56.77	59.39
	3.0	0.87	22.59	27.91	32.86	37.45	41.70	49.21	55.57	60.97	65.60	69.63
	4.0	1.47	22.84	28.31	33.48	38.34	42.90	51.18	58.39	64.70	70.25	75.18
	5.0	2.21	22.99	28.55	33.83	38.84	43.59	52.32	60.07	66.97	73.13	-

Table 11. Heating capacity (MBh)—Medium Fan Size (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)								
			450	500	600	700	900	1100	1300	1500	1700
1-Row Capacity MBh	1.0	0.88	21.31	22.66	24.86	25.56	29.01	30.73	32.05	33.11	34.02
	2.0	3.05	25.13	26.93	29.98	32.48	36.40	39.61	42.19	44.38	46.29
	3.0	6.35	26.68	28.74	32.29	35.26	39.99	43.70	46.79	49.59	52.12
	4.0	10.72	27.53	29.74	33.58	36.81	42.04	46.20	49.70	52.77	55.55
	5.0	16.12	28.07	30.37	34.40	37.81	43.37	47.83	51.61	54.95	57.99
2-Row Capacity MBh	1.0	0.08	25.66	26.72	28.35	29.53	31.16	32.25	33.04	33.66	34.16
	2.0	0.30	34.39	36.67	40.48	43.53	48.10	51.41	53.96	56.02	57.76
	3.0	0.63	37.48	40.34	45.27	49.39	55.87	60.81	64.77	68.07	70.93
	4.0	1.07	39.04	42.20	47.77	52.51	60.19	66.20	71.13	75.32	79.01
	5.0	1.63	40.01	43.36	49.35	54.51	63.01	69.80	75.44	80.31	84.63
3-Row Capacity MBh	1.0	0.11	30.95	32.23	34.17	35.56	37.43	38.64	39.49	40.14	40.66
	2.0	0.40	41.16	44.06	48.96	52.90	58.78	62.96	66.11	68.60	70.65
	3.0	0.82	44.47	48.09	54.50	59.94	68.63	75.24	80.47	84.78	88.42
	4.0	1.39	46.02	50.01	57.21	63.50	73.90	82.13	88.86	94.54	99.45
	5.0	2.10	46.93	51.14	58.84	65.68	77.22	86.60	94.42	101.14	107.63

Table 11. Heating capacity (MBh)—Medium Fan Size (I-P) (continued)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)								
			450	500	600	700	900	1100	1300	1500	1700
4-Row Capacity MBh	1.0	0.14	34.59	36.01	38.15	39.66	41.62	42.84	43.68	44.30	44.79
	2.0	0.49	45.48	48.86	54.64	59.29	66.20	71.01	74.54	77.26	79.44
	3.0	1.02	48.62	52.82	60.37	66.89	77.40	85,38	91.63	96.69	100.91
	4.0	1.71	49.97	54.55	62.97	70.49	83.12	93.23	101.49	108.39	114.29
	5.0	2.57	50.73	55.52	64.46	72.58	86.59	98.15	107.84	116.13	123.37

Table 12. Heating capacity (MBh)—Large Fan Size (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)							
			1100	1200	1400	1600	1800	2000	2200	2400
1-Row Capacity MBh	1.0	0.90	31.06	31.74	32.88	33.83	34.65	35.38	36.05	37.63
	2.0	3.08	40.04	41.37	43.70	45.70	47.48	49.11	50.63	53.46
	3.0	6.40	44.18	45.76	48.63	51.27	53.66	55.87	57.95	61.55
	4.0	10.79	46.71	48.50	51.72	54.60	57.26	59.85	62.30	66.42
	5.0	16.21	48.36	50.29	53.78	56.93	59.83	62.58	65.20	69.66
2-Row Capacity MBh	1.0	0.09	32.57	32.97	33.62	34.15	34.59	34.97	36.25	36.46
	2.0	0.30	51.95	53.26	55.49	57.34	58.92	60.32	63.34	64.33
	3.0	0.63	61.47	63.51	67.05	70.06	72.71	75.08	79.52	81.34
	4.0	1.08	66.92	69.46	73.93	77.79	81.23	84.36	89.84	92.33
	5.0	1.63	70.56	73.46	78.62	83.14	87.20	90.92	97.20	100.25
3-Row Capacity MBh	1.0	0.12	39.02	39.45	41.83	42.19	42.48	42.73	-	-
	2.0	0.40	63.62	65.26	71.05	72.94	74.53	75.90	-	-
	3.0	0.83	76.05	78.76	87.29	90.85	93.92	96.62	-	-
	4.0	1.40	83.02	86.50	96.94	101.81	106.09	109.92	-	-
	5.0	2.11	87.54	91.58	103.49	109.28	114.52	119.27	-	-
4-Row Capacity MBh	1.0	0.15	43.27	43.69	44.36	44.86	-	-	-	-
	2.0	0.50	71.75	73.60	76.61	78.97	-	-	-	-
	3.0	1.03	86.30	89.56	95.08	99.62	-	-	-	-
	4.0	1.73	94.24	98.53	105.98	112.28	-	-	-	-
	5.0	2.59	99.22	104.23	113.10	120.76	-	-	-	-

Table 13. Heating capacity (kW)—Small Fan Size (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)									
			94	118	142	165	189	236	283	330	378	425
1-Row Capacity MBh	0.47	2.21	3.24	3.93	4.48	4.94	5.31	5.93	6.42	6.79	7.10	7.37
	0.94	7.68	3.53	4.38	5.09	5.69	6.21	7.07	7.74	8.30	8.78	9.20
	1.42	16.05	3.64	4.55	5.33	6.00	6.58	7.55	8.34	9.00	9.57	10.07
	1.89	27.16	3.70	4.64	5.46	6.16	6.78	7.82	8.67	9.39	10.02	10.58
	2.36	40.94	3.73	4.70	5.54	6.27	6.91	7.99	8.89	9.64	10.31	10.90
2-Row Capacity MBh	0.47	0.21	4.29	5.04	5.60	6.05	6.40	6.93	7.30	7.58	7.80	7.98
	0.94	0.78	4.99	6.09	7.01	7.80	8.48	9.57	10.42	11.11	11.68	12.16
	1.42	1.67	5.21	6.43	7.49	8.42	9.24	10.63	11.74	12.67	13.46	14.15
	1.89	2.84	5.32	6.60	7.73	8.74	9.64	11.18	12.46	13.54	14.47	15.29
	2.36	4.33	5.39	6.71	7.88	8.94	9.89	11.54	12.92	14.11	15.14	16.06
3-Row Capacity MBh	0.47	0.30	5.20	6.12	6.83	7.39	7.84	8.51	8.98	9.33	9.60	9.81
	0.94	1.02	5.92	7.23	8.38	9.39	10.27	11.73	12.88	13.80	14.57	15.21
	1.42	2.12	6.13	7.56	8.86	10.03	11.10	12.93	14.46	15.74	16.84	17.79
	1.89	3.62	6.22	7.71	9.08	10.34	11.49	13.54	15.28	16.78	18.08	19.23
	2.36	5.47	6.28	7.80	9.21	10.52	11.73	13.91	15.79	17.43	18.88	20.18
4-Row Capacity MBh	0.47	0.36	5.79	6.84	7.67	8.32	8.85	9.63	10.17	10.56	10.86	11.10
	0.94	1.26	6.45	7.91	9.22	10.39	11.44	13.19	14.59	15.71	16.64	17.41
	1.42	2.60	6.62	8.18	9.63	10.98	12.22	14.42	16.29	17.87	19.23	20.41
	1.89	4.39	6.69	8.30	9.81	11.24	12.57	15.00	17.11	18.96	20.59	22.03
	2.36	6.60	6.74	8.37	9.91	11.38	12.77	15.33	17.60	19.63	21.43	-

Table 14. Heating capacity (kW)—Medium Fan Size (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)								
			212	236	283	330	425	519	614	708	802
1-Row Capacity MBh	0.47	2.63	6.25	6.64	7.29	7.49	8.50	9.01	9.39	9.70	9.97
	0.94	9.11	7.36	7.89	8.79	9.52	10.67	11.61	12.36	13.01	13.57
	1.42	18.98	7.82	8.42	9.46	10.33	11.72	12.81	13.71	14.53	15.27
	1.89	32.03	8.07	8.72	9.84	10.79	12.32	13.54	14.57	15.47	16.28
	2.36	48.17	8.23	8.90	10.08	11.08	12.71	14.02	15.13	16.10	17.00
2-Row Capacity MBh	0.47	0.24	7.52	7.83	8.31	8.65	9.13	9.45	9.68	9.86	10.01
	0.94	0.90	10.08	10.75	11.86	12.76	14.10	15.07	15.81	16.42	16.93
	1.42	1.88	10.98	11.82	13.27	14.47	16.37	17.82	18.98	19.95	20.79
	1.89	3.20	11.44	12.37	14.00	15.39	17.64	19.40	20.85	22.07	23.16
	2.36	4.87	11.73	12.71	14.46	15.98	18.47	20.46	22.11	23.54	24.80
3-Row Capacity MBh	0.47	0.33	9.07	9.45	10.01	10.42	10.97	11.32	11.57	11.76	11.92
	0.94	1.20	12.06	12.91	14.35	15.50	17.23	18.45	19.37	20.10	20.71
	1.42	2.45	13.03	14.09	15.97	17.57	20.11	22.05	23.58	24.85	25.91
	1.89	4.15	13.49	14.66	16.77	18.61	21.66	24.07	26.04	27.71	29.15
	2.36	6.28	13.75	14.99	17.24	19.25	22.63	25.38	27.67	29.64	31.54

Table 14. Heating capacity (kW)—Medium Fan Size (SI) (continued)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)								
			212	236	283	330	425	519	614	708	802
4-Row Capacity MBh	0.47	0.42	10.14	10.55	11.18	11.62	12.20	12.56	12.80	12.98	13.13
	0.94	1.46	13.33	14.32	16.01	17.38	19.40	20.81	21.85	22.64	23.28
	1.42	3.05	14.25	15.48	17.69	19.60	22.68	25.02	26.85	28.34	29.57
	1.89	5.11	14.64	15.99	18.45	20.66	24.36	27.32	29.74	31.77	33.50
	2.36	7.68	14.87	16.27	18.89	21.27	25.38	28.76	31.60	34.03	36.16

Table 15. Heating capacity (kW)—Large Fan Size (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)							
			519	566	661	755	850	944	1038	1133
1-Row Capacity MBh	0.5	2.69	9.10	9.30	9.64	9.91	10.15	10.37	10.57	11.03
	0.9	9.20	11.73	12.12	12.81	13.39	13.92	14.39	14.84	15.67
	1.4	19.13	12.95	13.41	14.25	15.03	15.73	16.37	16.98	18.04
	1.9	32.24	13.69	14.21	15.16	16.00	16.78	17.54	18.26	19.47
	2.4	48.44	14.17	14.74	15.76	16.68	17.53	18.34	19.11	20.42
2-Row Capacity MBh	0.5	0.27	9.55	9.66	9.85	10.01	10.14	10.25	10.62	10.69
	0.9	0.90	15.23	15.61	16.26	16.80	17.27	17.68	18.56	18.85
	1.4	1.88	18.02	18.61	19.65	20.53	21.31	22.00	23.31	23.84
	1.9	3.23	19.61	20.36	21.67	22.80	23.81	24.72	26.33	27.06
	2.4	4.87	20.68	21.53	23.04	24.37	25.56	26.65	28.49	29.38
3-Row Capacity MBh	0.5	0.36	11.44	11.56	12.26	12.36	12.45	12.52	-	-
	0.9	1.20	18.65	19.13	20.82	21.38	21.84	22.24	-	-
	1.4	2.48	22.29	23.08	25.58	26.63	27.53	28.32	-	-
	1.9	4.18	24.33	25.35	28.41	29.84	31.09	32.21	-	-
	2.4	6.31	25.66	26.84	30.33	32.03	33.56	34.95	-	-
4-Row Capacity MBh	0.5	0.45	12.68	12.80	13.00	13.15	-	-	-	-
	0.9	1.49	21.03	21.57	22.45	23.14	-	-	-	-
	1.4	3.08	25.29	26.25	27.87	29.20	-	-	-	-
	1.9	5.17	27.62	28.88	31.06	32.91	-	-	-	-
	2.4	7.74	29.08	30.55	33.15	35.39	-	-	-	-

Water Coil Notes (I-P)

- Fouling factor = 0.0005.
- Use the following equations to calculate leaving air temperature (LAT) and water temperature difference (WTD):

$$\text{LAT} = \text{EAT} + \left[\frac{\text{MBH} \times 921.7}{\text{Cfm}}\right]$$

$$\text{WTD} = \text{EWT} - \text{LWT} = \left(\frac{2 \times \text{MBh}}{\text{Gpm}}\right)$$

- Capacity based on 70°F entering air temperature and 180°F entering water temperature. Refer to correction factors for different entering conditions.

Table 16. Temperature correction factors for water pressure drop (ft)

Average Water Temperature	200	190	180	170	160	150	140	130	120	110
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 17. Temperature correction factors for coil capacity (MBh)

Entering Water Minus Entering Air	40	50	60	70	80	90	100	110	120	130
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Water Coil Notes (SI)

- Fouling factor = 0.0005.
- Use the following equations to calculate leaving air temperature (LAT) and water temperature difference (WTD).

$$LAT = EAT + \left(\frac{kW \times 0.83}{L/s}\right)$$

$$WTD = EWT - LWT = \left(\frac{kW}{(4.19)\ L/s}\right)$$

- Capacity based on 21°C entering air temperature and 82°C entering water temperature. Refer to correction factors for different entering conditions.

Table 18. Temperature correction factors for water pressure drop (kPa)

Average Water Temperature	93	88	82	77	71	66	60	54	49	43
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 19. Temperature correction factors for coil capacity (kW)

Entering Water Minus Entering Air	22	27	33	38	44	50	55	61	67	72
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Low Height Parallel Fan-Powered Terminal Units

Table 20. Primary airflow control factory settings — I-P

Air Valve Size (in.)	Maximum Valve Cfm	Maximum Controller Cfm	Minimum Controller Cfm	Constant Volume Cfm
5	350	40-350	0, 40-350	40-350
6	500	60-500	0, 60-500	60-500
8	900	105-900	0, 105-900	105-900
8x14	2200	200-2200	0, 220-2200	220-2200

Table 21. Primary airflow control factory settings — SI

Air Valve Size (in.)	Maximum Valve Cfm	Maximum Controller Cfm	Minimum Controller Cfm	Constant Volume Cfm
5	165	19-165	0, 19-165	19-165
6	236	28-236	0, 28-236	28-236
8	425	50-425	0, 50-425	50-425
8x14	1038	104-1038	0, 104-1038	104-1038

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 22. Coil air pressure drop

in.wg (I-P)			
Fan Size	Airflow Cfm	1-Row HW (in. wg)	2-Row HW (in. wg)
DS02	100	0.01	0.01
	250	0.01	0.04
	500	0.04	0.11
	750	0.10	0.19
	1000	0.18	0.30
	1300	0.32	0.44

Pa (SI)			
Fan Size	Airflow L/ s	1-Row HW (Pa)	2-Row HW (Pa)
DS02	47	2.5	2.5
	118	2.5	10
	236	10	27
	354	25	47
	472	45	75
	614	80	110

Note: HW Coil Only pressure drops do not include unit pressure drop.

Performance Data Fan Curves

Figure 18. Performance data fan curves, LPxF DS02 — ECM

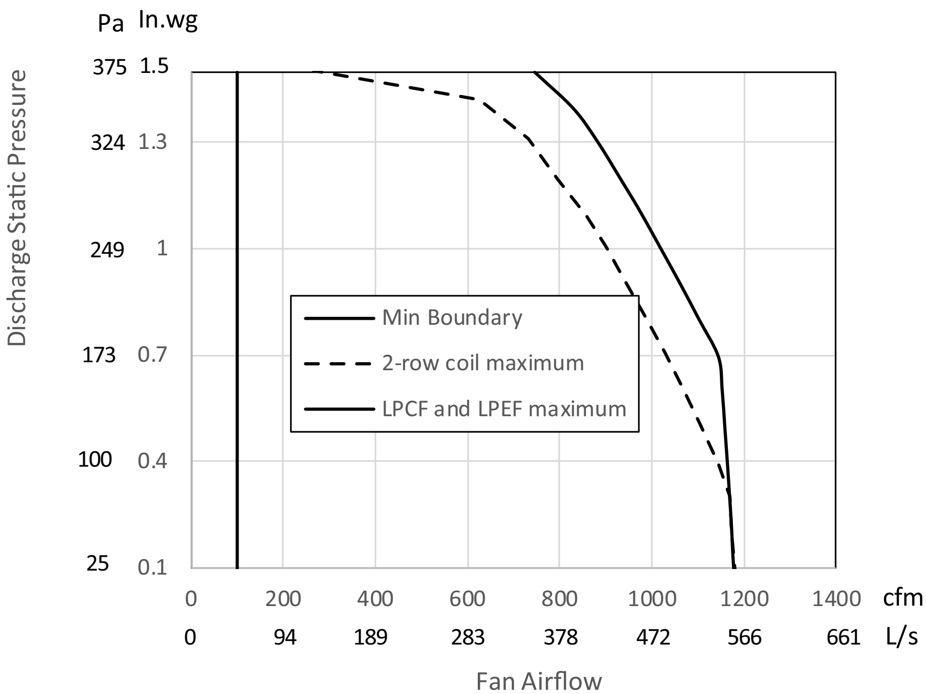


Table 23. Heating capacity (MBh) — fan size DS02 and I-P

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)												
			100	200	300	400	500	600	700	800	900	1000	1100	1200	1300
1	1.0	0.15	6.87	9.06	10.47	11.53	12.40	13.14	13.77	14.32	14.80	15.07	15.44	15.78	16.09
	2.0	0.58	7.70	10.70	12.78	14.46	15.90	17.15	18.27	19.28	20.20	20.48	21.23	21.93	22.57
	3.0	1.27	7.92	11.16	13.45	15.34	16.97	18.42	19.73	20.92	22.01	23.02	23.83	24.70	25.53
	4.0	2.24	8.08	11.48	13.94	15.98	17.76	19.36	20.82	22.16	23.39	24.54	25.41	26.41	27.36
	5.0	3.48	8.17	11.69	14.25	16.39	18.28	19.99	21.54	22.98	24.32	25.57	26.47	27.57	28.61
	6.0	4.98	8.24	11.83	14.47	16.69	18.65	20.43	22.06	23.58	24.99	26.31	27.24	28.41	29.51
2	1.0	0.76	9.04	14.59	18.26	20.87	22.83	24.35	25.53	26.58	27.42	28.14	28.81	29.34	29.81
	2.0	2.60	9.45	15.95	20.70	24.34	27.24	29.61	31.59	33.28	34.74	36.02	37.48	38.49	39.40
	3.0	5.39	9.59	16.43	21.60	25.68	29.01	31.78	34.14	36.17	37.95	39.53	41.45	42.17	43.86
	4.0	9.06	9.66	16.68	22.08	26.40	29.96	32.96	35.54	37.78	39.75	41.51	43.75	45.19	46.49
	5.0	13.57	9.70	16.83	22.37	26.85	30.56	33.71	36.43	38.80	40.90	42.78	45.25	46.80	48.21

Water Coil Notes (I-P)

- Fouling factor = 0.0005.
- The off-coil temperature of the hot water coil on parallel fan-powered units must not exceed 140°F when mounted on plenum inlet.
- Use the following equations to calculate leaving air temperature (LAT) and water temperature difference (WTD).

$$LAT = EAT + \left(\frac{MBH \times 921.7}{Cfm} \right)$$

$$WTD = EWT - LWT = \left(\frac{2 \times MBh}{Gpm} \right)$$

Capacity based on 70°F entering air temperature and 180°F entering water temperature. Refer to correction factors for different entering conditions.

Table 24. Temperature correction factors for water pressure drop (WPD)

Average Water Temperature	200	190	180	170	160	150	140	130	120	110
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 25. Temperature correction factors for coil capacity (MBh)

Entering Water Minus Entering Air	40	50	60	70	80	90	100	110	120	130
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Table 26. Heating capacity (kW) — fan sizes DS02 and SI

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)												
			47	94	142	189	236	283	330	378	425	472	519	566	614
1-Row Capacity MBh	0.06	0.45	2.01	2.66	3.07	3.38	3.64	3.85	4.04	4.20	4.34	4.42	4.53	4.62	4.72
	0.13	1.73	2.26	3.14	3.75	4.24	4.66	5.03	5.36	5.65	5.92	6.00	6.22	6.43	6.61
	0.19	3.80	2.32	3.27	3.94	4.50	4.97	5.40	5.78	6.13	6.45	6.75	6.98	7.24	7.48
	0.25	6.70	2.37	3.36	4.09	4.68	5.20	5.67	6.10	6.49	6.86	7.19	7.45	7.74	8.02
	0.32	10.40	2.39	3.43	4.18	4.80	5.36	5.86	6.31	6.74	7.13	7.49	7.76	8.08	8.38
	0.38	14.89	2.41	3.47	4.24	4.89	5.47	5.99	6.47	6.91	7.32	7.71	7.98	8.33	8.65
2-Row Capacity MBh	0.06	2.27	2.65	4.28	5.35	6.12	6.69	7.14	7.49	7.79	8.04	8.25	8.44	8.60	8.74
	0.13	7.77	2.77	4.67	6.07	7.13	7.98	8.68	9.26	9.75	10.18	10.56	10.98	11.28	11.55
	0.19	16.11	2.81	4.82	6.33	7.53	8.50	9.31	10.01	10.60	11.12	11.58	12.15	12.36	12.85
	0.25	27.08	2.83	4.89	6.47	7.74	8.78	9.66	10.42	11.07	11.65	12.16	12.82	13.24	13.62
	0.32	40.56	2.84	4.93	6.56	7.87	8.96	9.88	10.68	11.37	11.99	12.54	13.26	13.72	14.13

Water Coil Notes (SI)

- Fouling factor = 0.0005.
- Use the following equations to calculate leaving air temperature (LAT) and water temperature difference (WTD).

$$LAT = EAT + \left(\frac{kW \times 0.83}{L/s}\right)$$

$$WTD = EWT - LWT = \left(\frac{kW}{(4.19)\ L/s}\right)$$

- Capacity based on 21°C entering air temperature and 82°C entering water temperature. Refer to correction factors for different entering conditions.

Table 27. Temperature correction factors for water pressure drop (kPa)

Average Water Temperature	93	88	82	77	71	66	60	54	49	43
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 28. Temperature correction factors for coil capacity (kW)

Entering Water Minus Entering Air	22	27	33	38	44	50	55	61	67	72
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

DDC Controls

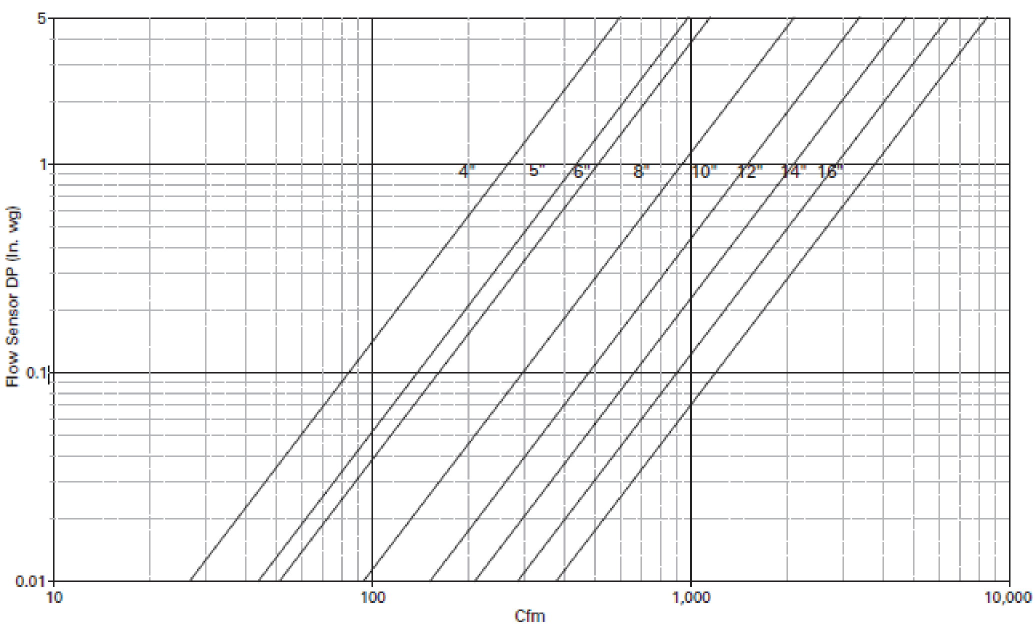
Control Logic

Direct Digital Control (DDC) controllers are today's industry standard. DDC controllers share system-level data to optimize system performance (including changing ventilation requirements, system static pressures, supply air temperatures, etc.). Variables available via a simple twisted-shielded wire pair include occupied/unoccupied status, minimum and maximum airflow setpoints, zone temperature and temperature setpoints, air valve position, airflow cfm, fan operation mode, reheat status (on or off), VAV unit type, air valve size, temperature correction offsets, flow correction values, ventilation fraction, and so on.

With the advent of the BACnet® open protocol, the most reliable VAV controller is now available for any system. Gone are the days of being locked into a single supplier. Trane DDC controllers provide Trane-designed solid-state electronics intended specifically for VAV applications including:

- Space temperature control
  - Parallel units provide variable speed ECM fan control
- Ventilation flow control (100% outside air applications)
- Flow tracking space pressurization control

Figure 19. Flow sensor single vs. airflow delivery



Space Temperature Control

Space temperature control (STC) logic modulates primary airflow, reheat (either local or remote), and fan airflow to maintain the desired temperature in the zone. Following are high-level descriptions of the STC control logic during occupied mode, for various fan and reheat configurations:

Parallel Fan-Powered Terminal

When the zone temperature is in the deadband between the active heating and cooling setpoints, the controller reduces primary airflow to the minimum primary airflow setpoint, while the fan and reheat are off.

When the zone temperature rises above the active cooling setpoint, the controller modulates primary airflow, between the minimum and maximum primary airflow setpoints, to maintain zone temperature at the active cooling setpoint, while the fan and reheat are off.

When the zone temperature is below the fan on/off setpoint (active heating setpoint plus fan offset), the controller turns on the fan, while primary airflow is controlled to the minimum primary airflow setpoint and the reheat remains off. The fan is turned off when the zone temperature rises to warmer than 0.5°F (0.28°C) above the fan on/off setpoint.

For units equipped with staged heat (on/off hot water or on/off electric):

When the zone temperature drops below the active heating setpoint, the controller stages heat on/off to maintain zone temperature at the active heating setpoint, while primary airflow is controlled to the minimum heating primary airflow setpoint. Stage 1 heat is energized when the zone temperature drops below the active heating setpoint; Stage 2 is energized when the zone temperature drops to 1°F (0.56°C) or more below the active heating setpoint. Stage 2 is de-energized when the zone temperature rises to warmer than 0.5°F (0.28°C) below the active heating setpoint; Stage 1 is de-energized when the zone temperature rises to warmer than 0.5°F (0.28°C) above the active heating setpoint.

For units equipped with modulated heat (modulated hot water or SCR electric):

When the zone temperature drops below the active heating setpoint, the controller modulates the hot-water valve (or SCR electric heater) to maintain zone temperature at the active heating setpoint, while primary airflow is controlled to the minimum heating primary airflow setpoint.

Variable Volume ECM

Parallel fan powered units with Trane BACnet® controls provide improved efficiency, acoustics, and thermal comfort via optional variable speed ECM fan control.

Air-Fi Wireless Communications Interface (WCI)

The Trane Air-Fi® Wireless Communications Interface (WCI) enables wireless communication between system controls, unit controls, and wireless sensors for Trane control products that use the BACnet® protocol. The WCI replaces the need for communications wire in all system applications.

Note: *See Air-Fi® Wireless System Installation, Operation, and Maintenance (BAS-SVX40*-EN) for more information.*

Air-Fi® Wireless Communications Sensor (WCS)

The Air-Fi Wireless Communications Sensor (WCS) is compatible with any Trane controller that uses a WCI. The WCS provides the same functions as many currently available Trane wired sensors. No further software or hardware is necessary for site evaluation, installation, or maintenance. Space temperature is standard on all models.

Note: *A service tool cannot be connected to a Trane wireless sensor.*

Three WCS models are available:

- Digital display (WCS-SD) model.
- Base (WCS-SB) model has no exposed display or user interface.
- 2% relative humidity sensor module (WCS-SH), which can be field installed inside either the WCS-SD or WCS-SB.

In most applications, one WCS-SD or WCS-SB sensor will be used per WCI acting as a router. However, up to 6 WCS-SD or WCS-SB sensors can be associated to a single equipment controller or BCI.

CO_2 Wall Sensor

Carbon dioxide (CO_2) sensors are designed for use with Trane DDC control systems. Installation is made simple by attachment directly to the DDC controller. This allows the existing communication link to be used to send CO_2 data to the higher-level Trane control system.

Wall-mounted sensors can monitor individual zones, and the duct-mounted sensor is ideal for monitoring return air of a given unit. Long-term stability and reliability are assured with advanced silicon based Non-Dispersive Infrared (NDIR) technology.

When connected to a building automation system with the appropriate ventilation equipment, the Trane CO_2 sensors measure and record carbon dioxide in parts-per-million (ppm) in occupied building spaces. These carbon dioxide measurements are typically used to identify under-ventilated building zones and to override outdoor airflow beyond design ventilation rates if the CO_2 exceeds acceptable levels.

DDC Zone Sensor

The DDC zone sensor with LCD has the look and functionality of the standard Trane DDC zone sensor but has a LCD display. The sensor includes setpoint adjustment, the display of the ambient temperature, a communication jack, and occupied mode override push buttons. Also, it can be configured in the field for either a Fahrenheit or Celsius display, a continuous display of the setpoint and the offset of displayed temperatures.

The DDC zone sensor is used in conjunction with the Trane direct digital controller to sense the space temperature and to allow for user adjustment of the zone setpoint. Models with external zone setpoint adjustments and occupied mode override push buttons are available.

Auxiliary Temperature Sensor

The auxiliary temperature sensor is used in conjunction with the Trane DDC controller to sense duct temperature. When the DDC controller is used with a Building Automation System, the sensor temperature is reported as status only. When the DDC control is used as stand alone configuration and the sensor is placed in the supply air duct, the sensor determines the control action of the unit in a heat/cool changeover system.

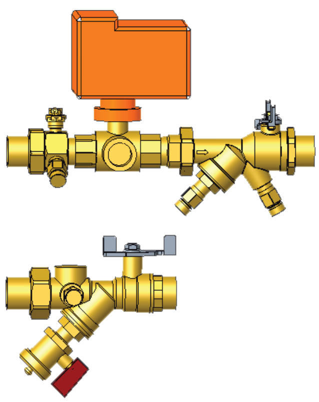
Trane Control Valves

The modulating water valve is used to provide accurate control of a hot water heating coil to help maintain a zone temperature setpoint. The valve plug is an equal percentage design and comes available in four different flow capacities for proper controllability. The valves are field-adjustable for use as a two- or three-way configuration. The valves ship in a two-way configuration with a cap over the bottom port. Conversion to three-way operation is accomplished by removing the plug from the "B" port. The valve actuator contains a three-wire synchronous motor.
The direct digital controller uses a time-based signal to drive the motor to its proper position. When power is removed from the valve, it remains in its last controlled position.

Belimo Control Valves

The modulating water valve is used to provide accurate control of a hot water heating coil to help maintain a zone temperature setpoint. The valves available in seven different flow capacities for proper controllability. The valves are selectable in a two- or three-way configuration. The valve actuator contains a three-wire synchronous motor. The direct digital controller uses a time-based signal to drive the motor to its proper position. When power is removed from the valve, it remains in its last controlled position.

VAV Piping Package



- Offered in both two-way and three-way configurations
- The automatic balancing flow control sized for the specified VAV coil and gpm.
- Field connections are NPT with coil connections sweat to match the Trane VAV water coil copper
- For three-way configuration, the connections between the ATC valve and the supply shut off assembly are sweat connections to allow for field installation of hoses or hard piping between the supply and return lines. Included in the package are:
  – P/T ports for pressure and temperature measurement on both the supply and return sections.
  – Blow down drainable filter on the supply.
  – Y-Ball combination Mesurflo automatic balance valve on the return side to isolate the coil.
  – Y-Ball combination strainer on the supply to isolate the coil.

- Each piping package is tagged to match the specific VAV terminal.
- Each piping package includes a 24V floating point control modulating control ball valve or a 2V to 10V analog control ball valve.
- The Cv is sized to match the specified gpm/coil performance of the VAV terminal unit. Package includes unions with sweat connections to the coil.

Differential Pressure Transducer

The differential pressure transducer is used in conjunction with the Trane direct digital controller and analog electronic controller. The pressure transducer measures the difference between the high-pressure and low-pressure ports of the Trane flow ring. The transducer is self-adjusting to changes in environmental temperature and humidity.

Transformers

The transformer converts primary power supply voltages to the voltage required by the direct digital controller and analog. The transformer also serves to isolate the controller from other controllers which may be connected to the same power source.

Trane Actuator – 90 Second at 60 Hz Drive Time

This actuator is used with DDC controls and retrofit kits. It is available with a 3-wire floating-point control device. It is a direct-coupled over the shaft (minimum shaft length of 2.1 inches), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator has an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

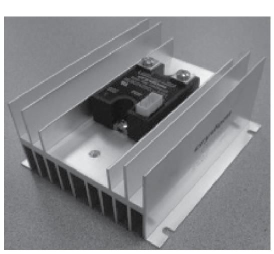
Belimo Actuator – 95 Second Drive Time

This actuator is used with DDC controls and retrofit kits. It is available with a 3-wire floating-point control device. It is a direct-coupled over the shaft enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator has an external manual gear release to allow manual positioning of the damper. The actuator is UL listed and caries the CE mark.

Trane Spring Return Actuator

This actuator is used with DDC controls and is a floating-point control device. It is direct-coupled over the shaft (minimum shaft length of 2.1 inches), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator is Underwriters Laboratories Standard 60730 and Canadian Standards Association C22.2 No. 24-93 certified as meeting correct safety requirements and recognized industry standards.

Electric Heater Silicon-Controlled Rectifier (SCR)



- Microprocessor based burst-fire controller / SSR
- Low-voltage control
- Output status indicator
- 0-100% Control Range
- Synchronized triggering output (P3)
- 20 AC Cycles Base Period

Controls Specifications

For all VariTrane™ units, the unit controller continuously monitors the zone temperature and varies the primary airflow as required to meet zone temperature and ventilation setpoints. Airflow is limited by adjustable minimum and maximum airflow setpoints.

For parallel fan-powered units, the controller energizes the fan upon a call for heat. Upon a further call for heat, reheat is enabled.

Electrical Data

Parallel Fan-Powered Terminal Units

Table 29. VPEG with PSC — electric heater kW guidelines — minimum to maximum

Fan Size		Single-Phase Voltage					Three-Phase Voltage		
	Stages	120V	208V	240V	277V	480V	208V	480V	380V/50Hz
Small	1	1.0-5.0	1.0-9.0	1.0 - 10.0	1.0-12.0	1.0-9.0	-	1.0-12.0	1.0- 12.0
	2	1.0-5.0	1.0-9.0	1.0 - 10.0	1.0-12.0	1.0-9.0	-	1.0-12.0	1.0- 12.0
Medium	1	-	3.0 - 8.0	3.0 - 9.0	3.0-12.0	3.0-20.0	-	3.0-20.0	3.0-20.0
	2	-	3.0 - 8.0	3.0 - 9.0	3.0-12.0	3.0-20.0	-	3.0-20.0	3.0-20.0
Large	1	-	5.0 - 8.0	-	5.0-11.0	5.0-20.0	5.0-14.0	5.0-22.0	5.0-22.0
	2	-	5.0 - 8.0	-	5.0-11.0	5.0-20.0	5.0-14.0	5.0-22.0	5.0-22.0

Table 30. VPEG with ECM — electric heater kW guidelines — minimum to maximum

Fan Size		Single-Phase Voltage					Three-Phase Voltage		
	Stages	120V	208V	240V	277V	480V	208V	480V	380V /50Hz
Small	1	1.0-5.0	1.0-9.0	1.0-10.0	1.0-12.0	1.0-9.0	1.0-12.0	1.0-12.0	-
	2	1.0-5.0	1.0-9.0	1.0-10.0	1.0-12.0	1.0-9.0	1.0-12.0	1.0-12.0	-
Medium	1	-	3.0-8.0	3.0-8.0	3.0-12.0	3.0-20.0	3.0-14.0	3.0-20.0	-
	2	-	3.0-8.0	3.0-8.0	3.0-12.0	3.0-20.0	3.0-14.0	3.0-20.0	-
Large	1	-	5.0-7.0	5.0-8.0	5.0-11.0	5.0-20.0	5.0-12.0	5.0-22.0	-
	2	-	5.0-7.0	5.0-8.0	5.0-11.0	5.0-20.0	5.0-12.0	5.0-22.0	-

Notes:

1. Heater kW step sizes: 0.5 kw for kw's up to 8; 1.0 kw for kw's from 8 to 18 kw; 2.0 kw for heater kw's from 18 kw and up.
2. Heaters available in 1 or 2 stages.

Table 31. Fan electrical performance (PSC)

Fan Size	HP	Maximum Fan Motor Amperage (FLA)		
		115 Vac	208 VAC	277 VAC
Small	1/3	4.34	—	1.30
Medium	1/2	6.80	—	2.40
Large	1	—	6.60	4.74

Notes:

1. Electric Heat Units - Small and Medium units with a primary voltage of 208/60/1, 208/60/3, or 240/60/1 have 115/60/1 Vac fan motors. Large units with the same voltages, have 208/60/1 Vac motors.
2. Electric Heat Units - Units with primary voltage of 277/60/1, 480/60/1 or 480/60/3 use 277 Vac fan motors.
3. With 380/50/3 use 230/50 motors.

Table 32. Fan electrical performance (ECM)

Fan Size	HP	Maximum Fan Motor Amperage (FLA)		
		115 Vac	208 VAC	277 VAC
Small	1/3	5.30	3.10	2.30
Medium	3/4	10.60	5.20	4.10
Large	1	12.80	6.70	5.20

Notes:

1. Electric heat units-units with primary voltages of 208/60/1 and 208/60/3 have optional 120-Vac or 208-Vac fan motors.
2. Electric heat units-units with primary voltages of 240/60/1 have 120-Vac or 240-Vac fan motors.
3. Electric heat units—units with primary voltages of 277/60/1, 480/60/1, or 480/60/3 have 277-Vac fan motors.

Table 33. Minimum electric heat unit CFM guidelines (PSC)

Unit kW	Cfm		
	Small	Medium	Large
1.0	162	—	—
1.5	162	—	—
2.0	162	—	—
2.5	197	—	—
3.0	236	300	—
3.5	275	300	—
4.0	315	315	—
4.5	354	354	—
5.0	393	393	470
5.5	432	432	470
6.0	472	472	472
6.5	511	511	511
7.0	550	550	550
7.5	590	590	590
8.0	629	629	629
9.0	708	708	708
10.0	786	786	786
11.0	865	865	865
12.0	—	944	944
13.0	—	1022	1022
14.0	—	1101	1101
15.0	—	1179	1179
16.0	—	1258	1258
17.0	—	1337	1337
18.0	—	1415	1415
20.0	—	1573	1573
22.0	—	—	1730

Table 34. Minimum electric heat unit L/s guidelines (PSC)

Unit kW	Cfm		
	Small	Medium	Large
1.0	76	—	—
1.5	76	—	—
2.0	76	—	—
2.5	93	—	—
3.0	111	142	—
3.5	130	142	—
4.0	148	148	—
4.5	167	167	—

Table 34. Minimum electric heat unit L/s guidelines (PSC) (continued)

Unit kW	Cfm		
	Small	Medium	Large
5.0	186	186	222
5.5	204	204	222
6.0	223	223	223
6.5	241	241	241
7.0	260	260	260
7.5	278	278	278
8.0	297	297	297
9.0	334	334	334
10.0	371	371	371
11.0	408	408	408
12.0	445	445	445
13.0	—	482	482
14.0	—	520	520
15.0	—	557	557
16.0	—	594	594
17.0	—	631	631
18.0	—	668	668
20.0	—	742	742
22.0	—	—	816

Table 35. Minimum electric heat unit CFM guidelines (ECM)

Unit kW	Cfm		
	Small	Medium	Large
1.0	140	—	—
1.5	140	—	—
2.0	157	—	—
2.5	197	—	—
3.0	236	300	—
3.5	275	300	—
4.0	315	315	—
4.5	354	354	—
5.0	393	393	600
5.5	432	432	600
6.0	472	472	600
6.5	511	511	600
7.0	550	550	600
7.5	590	590	600
8.0	629	629	629
9.0	708	708	708

Table 35. Minimum electric heat unit CFM guidelines (ECM) (continued)

Unit kW	Cfm		
	Small	Medium	Large
10.0	786	786	786
11.0	865	865	865
12.0	944	944	944
13.0	—	1022	1022
14.0	—	1101	1101
15.0	—	1179	1179
16.0	—	1258	1258
17.0	—	1337	1337
18.0	—	1415	1415
20.0	—	1573	1573
22.0	—	—	1730

Table 36. Minimum electric heat unit L/s guidelines (ECM)

Unit kW	Cfm		
	Small	Medium	Large
1.0	66	—	—
1.5	66	—	—
2.0	74	—	—
2.5	93	—	—
3.0	111	142	—
3.5	130	142	—
4.0	148	148	—
4.5	167	167	—
5.0	186	186	222
5.5	204	204	222
6.0	223	223	223
6.5	241	241	241
7.0	260	260	260
7.5	278	278	278
8.0	297	297	297
9.0	334	334	334
10.0	371	371	371
11.0	408	408	408
12.0	445	445	445
13.0	—	482	482
14.0	—	520	520
15.0	—	557	557
16.0	—	594	594
17.0	—	631	631

Table 36. Minimum electric heat unit L/s guidelines (ECM) (continued)

Unit kW	Cfm		
	Small	Medium	Large
18.0	—	668	668
20.0	—	742	742
22.0	—	—	816

Low Height Parallel Fan-Powered Terminal Units

Table 37. LPEF — electric coil kW guidelines — minimum to maximum (ECM units)

Fan Size	Stages	Single-Phase Voltage					Three-Phase Voltage	
		120V	208V	240V	277V	480V	208V	480V
DS02	1	1.0-4.5	1.0-9.0[a]	1.0-9.0	1.0-13.0	1.0–14.0	1.0–14.0[b]	1.0–14.0
	2	1.0-4.5	1.0-9.0[a]	1.0-9.0	1.0-13.0	1.0–14.0	1.0–14.0[b]	1.0–14.0

(a) 8-9 kW not available with 115V motor.
(b) 14 kW not available with 115V motor.

Table 38. Fan electrical performance (ECM)

Fan Size	HP	Maximum Fan Motor Amperage (FLA)		
		115 VAC	208 VAC	277 VAC
DS02	0.75	9.6	6.6	5.2

Notes:

1. Electric heat units with primary voltages of 208/60/1 and 208/60/3 have optional 115-VAC or 208-VAC fan motors.
2. Electric heat units with primary voltages of 240/60/1 have 115-VAC fan motors.
3. Electric heat units with primary voltages of 277/60/1, 480/60/1 or 480/60/3 use 277 VAC fan motors.

Table 39. Minimum unit electric heat guidelines (ECM)

Unit kW	DS02	
	Cfm	L/s
1	100	47
1.5	100	47
2	126	60
2.5	158	75
3	189	90
3.5	221	105
4	252	119
4.5	284	135
5	315	149
5.5	346	164
6	378	179
6.5	409	194
7	441	209
7.5	472	223
8	504	238
9	567	268
10	629	297
11	692	327

Table 39. Minimum unit electric heat guidelines (ECM) (continued)

Unit kW	DS02	
	Cfm	L/s
12	755	357
13	818	387
14	881	416

Formulas

Fan-Powered Parallel

Minimum circuit Ampacity (MCA) Equation

MCA = 1.25 x (s motor amps + heater amps)

Motor amps is the sum of all motor current draws if more than one is used in the unit.

Maximum Overcurrent Protection (MOP) Equation

MOP = (2.25 x motor1 amps) + motor2 amps + heater amps

motor1 amps = current draw of largest motor

motor2 amps = sum of current of all other motors used in unit

General Sizing Rule:

- If MOP = 15, then fuse size = 15
- If MOP = 19, then fuse size = 15 with one exception. If heater amps x 1.25 > 15, then fuse size = 20.
- If MOP is equal to or less than MCA, then choose next fuse size greater than MCA.
- Control fusing not applicable.
- Standard Fuse Sizes: 15, 20, 25, 30, 35, 40, 45, 50, and 60.

Example:

A model VPEF, electric reheat unit size 10-05SQ has 480/3 phase, 12 kW electric reheat with 2 stages and 277-Volt motor.

- For MOP of fan-powered unit:
  – 12 kW-480/3 heater:12x1000/480x1.73=14.45 amps
  – MCA = (2.4 + 14.45) x 1.25 = 21.06, MOP = (2.25 x 2.4) + 14.45 = 19.9.
  – Since MOP is less than or equal to MCA, then MOP = 25.
- For total current draw of unit:
  – 12kW-480/3 heater:12x1000/480x1.73=14.45
  – Two heat outputs (2 stages) @0.5 amps max each=1.00
  – Motor amps: 277 V (Fan size 0517) =2.4
  – Amps Max: 18.35

Useful Formulas: See "Useful Formulas," p. 56 .

Low-Height Parallel Fan-Powered

Minimum Circuit Ampacity (MCA) Equation

MCA = (2.25 x motor amps + heater amps) x 1.25

Maximum Overcurrent Protection (MOP) Equation

MOP = (2.25 x motor amps) + heater amps

General Sizing Rules

- If MOP = 15, then fuse size = 15
- If MOP = 19, then fuse size = 15 with one exception. If heater amps x 1.25 > 15, then fuse size = 20.
- If MOP is less than/equal to MCA, then choose next fuse size greater than MCA.

- Control fusing not applicable.
- Standard Fuse Sizes: 15, 20, 25, 30, 35, 40, 45, 50, and 60.

Useful Formulas: See "Useful Formulas," p. 56.

Useful Formulas

$$kW = \frac{Cfm \times ATD}{3154}$$

$$ATD = \frac{kW \times 3154}{Cfm}$$

$$ATD = \frac{kW}{1214 \times L/s}$$

$$3\varphi amps = \frac{kW \times 1000}{Primary\ Voltage \times \sqrt{3}}$$

$$1\varphi amps = \frac{kW \times 1000}{Primary\ Voltage}$$

$$kW = 1214 \times L/s \times ATD$$

Acoustics Data

Parallel Fan-Powered Terminal Units

Table 40. AHRI 885-2008 discharge transfer function assumptions

	Octave Band					
	2	3	4	5	6	7
Small Box (<300 Cfm)	-24	-28	-39	-53	-59	-40
Medium Box (300-700 Cfm)	-27	-29	-40	-51	-53	-39
Large Box (>700 Cfm)	-29	-30	-41	-51	-52	-39

Notes:

1. Subtract from terminal unit sound power to determine discharge sound pressure in the space.
2. NC Values are calculated using current Industry Standard AHRI 885-2008. Radiated Transfer Function obtained from Appendix E, Type 2 Mineral Fiber Insulation.
3. Application ratings are outside the scope of the Certification Program.

Table 41. AHRI 885-2008 radiated transfer function assumptions:

	Octave Band					
	2	3	4	5	6	7
Type 2- Mineral Fiber Insulation	-18	-19	-20	-26	-31	-36
Total dB reduction	-18	-19	-20	-26	-31	-36

Notes:

1. Subtract from terminal unit sound power to determine discharge sound pressure in the space.
2. NC Values are calculated using current Industry Standard AHRI 885-2008. Radiated Transfer Function obtained from Appendix E, Type 2 Mineral Fiber Insulation.
3. Application ratings are outside the scope of the Certification Program.

Low Height Parallel Fan-Powered Terminal Units

Contact the local Trane office for low height parallel acoustics information, including:

- Discharge sound power
- Radiated sound power
- Fan-only sound power
- AHRI 885-2008 discharge transfer function assumptions
- AHRI 885-2008 radiated transfer function assumptions
- Sound noise criteria (valve only)
- Sound noise criteria (fan only)
- Discharge sound power – AHRI conditions (fan only)
- Radiated sound power – AHRI conditions (fan only)
- Inlet attenuator appurtenance effects (fan noise only)
- Cabinet lining appurtenance effects (fan noise and valve noise)
- Heating coil appurtenance effects

Table 42. Discharge sound power (dB) — 100% primary air — cooling cycle — DS02

Fan Size	Inlet Size (in.)	Air Flow		Fan and 100% Primary Air - Octave Band Sound Power @ Primary Air Inlet Static Pressure Indicated											
		CFM	L/s	0.5" w.g.						1.0" w.g.					
				2	3	4	5	6	7	2	3	4	5	6	7
DS02 ECM	5	100	47	49	42	37	30	24	29	52	46	41	34	29	36
		225	106	60	51	44	40	34	33	62	54	49	43	39	39
		350	165	66	56	50	46	42	34	69	60	54	50	46	41
DS02 ECM	6	100	47	47	40	35	29	24	29	50	44	40	34	29	35
		225	106	57	48	43	38	33	32	60	53	48	42	38	38
		400	189	65	56	49	45	42	36	68	60	54	50	47	42
		500	236	69	59	52	48	46	38	71	63	57	53	51	43
DS02 ECM	8	100	47	45	39	38	32	28	33	48	43	41	36	32	39
		300	142	57	49	44	39	34	34	60	52	48	43	38	39
		500	236	64	55	50	46	42	38	67	59	54	50	46	44
		700	330	69	60	55	52	49	43	71	64	59	55	53	48
		900	425	72	64	59	57	54	47	75	68	63	60	58	52
DS02 ECM	8X14	100	47	52	46	37	28	22	24	56	52	43	34	28	31
		400	189	61	54	47	41	37	33	65	59	52	46	42	39
		700	330	66	59	52	47	44	39	70	64	57	53	50	45
		1000	472	70	62	56	52	49	43	74	67	61	57	54	50
		1300	614	73	65	59	55	52	47	77	70	64	60	58	53
Fan Size	Inlet Size (in.)	Air Flow		Fan and 100% Primary Air - Octave Band Sound Power @ Primary Air Inlet Static Pressure Indicated											
		CFM	L/s	1.5" w.g.						2.0" w.g.					
				2	3	4	5	6	7	2	3	4	5	6	7
DS02 ECM	5	100	47	53	48	43	36	31	40	54	49	45	38	33	43
		225	106	64	56	51	45	41	43	65	58	53	47	43	46
		350	165	70	62	56	52	49	45	71	63	58	53	51	47
DS02 ECM	6	100	47	52	47	43	36	32	39	53	49	45	38	34	41
		225	106	62	55	50	45	41	42	63	57	53	47	43	45
		400	189	70	63	57	52	50	45	71	65	59	54	52	48
		500	236	73	66	60	55	54	47	74	68	62	57	56	49
DS02 ECM	8	100	47	49	45	44	38	34	42	50	46	45	39	36	44
		300	142	62	54	50	45	41	42	63	56	52	46	42	45
		500	236	68	61	56	52	49	47	69	62	58	53	50	49
		700	330	73	66	61	57	55	51	74	67	62	59	57	54
		900	425	77	70	65	62	61	55	78	71	66	64	63	58
DS02 ECM	8X14	100	47	58	55	46	37	31	34	60	57	48	39	34	37
		400	189	67	62	55	49	46	43	69	64	57	51	48	46
		700	330	73	67	60	56	53	49	74	69	63	58	55	52
		1000	472	77	70	64	60	58	54	78	72	66	62	60	56
		1300	614	80	73	67	64	62	57	81	75	69	66	64	60

Notes:

1. All data measured in accordance with industry standard AHRI 880-2011.
2. Sound power levels are in decibels, dB re 10^{-12} watts.
3. Discharge static pressure is 0.25" w.g.

Table 43. Radiated sound power (dB) — 100% primary air — cooling cycle — DS02

Fan Size	Inlet Size (in.)	Air Flow		Fan and 100% Primary Air - Octave Band Sound Power @ Primary Air Inlet Static Pressure Indicated											
		CFM	L/s	0.5" w.g.						1.0" w.g.					
				2	3	4	5	6	7	2	3	4	5	6	7
DS02 ECM	5	100	47	37	32	26	19	16	16	40	36	32	25	22	23
		225	103	48	40	33	24	20	17	51	44	39	31	27	24
		350	165	55	46	37	28	23	17	58	50	43	34	30	25
DS02 ECM	6	100	47	37	31	28	23	18	14	40	35	33	27	23	20
		225	103	47	40	35	28	24	18	51	45	40	33	28	23
		400	189	55	49	42	35	31	21	59	53	47	40	35	27
		500	236	59	52	45	39	34	23	62	56	50	43	38	29
DS02 ECM	8	100	47	38	33	31	26	23	22	41	37	36	31	29	27
		300	142	48	41	38	32	23	18	51	45	42	37	29	24
		500	236	55	47	43	36	28	21	58	52	48	41	34	26
		700	330	60	53	47	40	32	23	63	57	52	45	38	29
		900	425	64	57	50	43	36	26	68	62	55	48	42	31
DS02 ECM	8X14	100	47	47	42	37	35	32	35	49	45	40	38	35	38
		400	189	59	52	45	38	32	31	61	55	48	41	35	34
		700	330	64	58	50	43	36	33	67	61	53	46	39	36
		1000	472	68	62	54	47	40	36	71	64	57	50	43	39
		1300	614	71	65	57	50	44	38	74	67	60	53	47	41
Fan Size	Inlet Size (in.)	Air Flow		Fan and 100% Primary Air - Octave Band Sound Power @ Primary Air Inlet Static Pressure Indicated											
		CFM	L/s	1.5" w.g.						2.0" w.g.					
				2	3	4	5	6	7	2	3	4	5	6	7
DS02 ECM	5	100	47	42	38	36	29	26	27	44	40	38	32	29	30
		225	103	53	47	42	35	30	28	54	49	45	37	33	31
		350	165	60	52	47	38	34	29	61	54	49	41	36	32
DS02 ECM	6	100	47	43	38	36	30	25	23	44	40	38	31	27	26
		225	103	53	47	43	35	31	27	54	49	45	37	33	29
		400	189	61	55	50	42	38	30	63	57	52	44	40	33
		500	236	65	59	53	46	41	32	66	61	55	47	43	34
DS02 ECM	8	100	47	43	40	39	34	32	31	45	42	41	36	35	33
		300	142	53	48	45	39	33	27	55	50	47	41	35	29
		500	236	60	54	50	44	37	29	62	56	52	46	40	32
		700	330	66	60	54	48	42	32	67	62	56	50	44	34
		900	425	70	64	58	51	46	35	72	66	59	53	48	37
DS02 ECM	8X14	100	47	49	45	40	38	35	38	51	46	42	40	37	40
		400	189	61	55	48	41	35	34	62	57	50	43	37	36
		700	330	67	61	53	46	39	36	68	62	55	48	41	38
		1000	472	71	64	57	50	43	39	72	66	59	52	46	41
		1300	614	74	67	60	53	47	41	75	69	62	55	49	44

Notes:

1. All data measured in accordance with industry standard AHRI 880-2011.
2. Sound power levels are in decibels, dB re 10^{-12} watts.
3. AHRI 880-2011 certification points appear shaded, remaining application points are beyond the scope of the certification program.
4. Discharge static pressure is 0.25" w.g.

Table 44. Fan only sound power (dB) — heating cycle — DS02

Fan Size	Inlet Size (in.)	Airflow		Discharge						Radiated					
		CFM	L/s	2	3	4	5	6	7	2	3	4	5	6	7
DS02 ECM	5	100	47	55	47	40	38	23	25	55	52	49	44	30	23
		225	106	56	53	48	42	31	33	55	52	50	45	32	27
		350	165	59	56	52	46	37	39	56	55	53	47	35	29
DS02 ECM	6	100	47	55	47	40	38	23	25	55	52	49	44	30	23
		225	106	56	53	48	42	31	33	55	52	50	45	32	27
		400	189	60	58	54	48	40	41	58	56	54	48	36	31
		500	236	63	61	57	51	44	45	60	59	57	50	39	34
DS02 ECM	8	100	47	55	47	40	38	23	25	55	52	49	44	30	23
		300	142	57	55	50	44	35	36	55	53	51	46	33	28
		500	236	63	61	57	51	44	45	60	59	57	50	39	34
		700	330	68	66	63	57	51	53	65	64	62	55	45	40
		900	425	74	70	67	62	57	60	71	69	66	60	50	45
DS02 ECM	8x14	100	47	55	47	40	38	23	25	55	52	49	44	30	23
		400	189	60	58	54	48	40	41	58	56	54	48	36	31
		700	330	68	66	63	57	51	53	65	64	62	55	45	40
		1000	472	76	72	69	64	60	62	73	71	68	62	52	48
		1300	614	83	77	74	71	67	70	80	78	72	67	58	56

Notes:

1. All data measured in accordance with industry standard AHRI 880-2011.
2. Sound power levels are in decibels, dB re 10^{-12} watts.
3. AHRI 880-2011 certification points appear shaded, remaining application points are beyond the scope of the certification program.
4. Discharge static pressure is 0.25" w.g.

Table 45. Sound noise criteria (NC) — fan and 100% primary Air — Cooling Cycle — DS02

Fan Size	Inlet Size (in.)	Airflow		NC Levels @ Primary Air Inlet Static Pressure Indicated											
				Discharge						Radiated					
		CFM	L/s	Fan Only	0.5" w. g.	1.0" w. g.	1.5" w. g.	2.0" w. g.	3.0" w. g.	Fan Only	0.5" w. g.	1.0" w. g.	1.5" w. g.	2.0" w. g.	3.0" w. g.
DS02 ECM	5	100	47	9	1	4	6	7	10	23	-2	5	8	11	15
		225	106	10	15	18	20	21	23	24	7	12	16	19	22
		350	165	14	23	26	27	29	31	27	16	20	22	24	27
DS02 ECM	6	100	47	9	-2	2	4	6	9	23	1	6	9	11	14
		225	106	10	11	15	17	19	21	24	8	13	16	19	22
		400	189	16	22	25	28	29	31	28	16	21	24	26	29
		500	236	20	26	29	32	33	35	31	21	25	28	30	33
DS02 ECM	8	100	47	9	-3	2	5	7	11	23	4	9	12	14	17
		300	142	13	11	15	17	18	20	25	11	16	19	21	24
		500	236	20	20	23	25	27	29	31	16	21	24	26	29
		700	330	26	26	29	31	33	35	37	22	27	30	32	35
		900	425	32	31	34	36	37	39	41	28	32	35	37	40

Table 45. Sound noise criteria (NC) — fan and 100% primary Air — Cooling Cycle — DS02 (continued)

Fan Size	Inlet Size (in.)	Airflow		NC Levels @ Primary Air Inlet Static Pressure Indicated											
				Discharge						Radiated					
		CFM	L/s	Fan Only	0.5" w. g.	1.0" w. g.	1.5" w. g.	2.0" w. g.	3.0" w. g.	Fan Only	0.5" w. g.	1.0" w. g.	1.5" w. g.	2.0" w. g.	3.0" w. g.
DS02 ECM	8x14	100	47	9	4	9	12	15	19	23	5	10	13	15	18
		400	189	16	16	21	24	26	29	28	16	21	24	26	29
		700	330	26	23	28	31	33	36	37	23	28	31	33	36
		1000	472	35	28	33	36	38	41	43	28	33	36	38	41
		1300	614	45	32	37	40	42	45	50	32	37	40	42	45

Notes:
1. "–" represents NC levels below NC 15.
2. NC values are calculated using modeling assumptions based on AHRI 885-2008 Appendix E.

Table 46. AHRI 885-2008 add discharge transfer function assumptions

	Octave Band					
	2	3	4	5	6	7
Small Box (<300 Cfm)	-24	-28	-39	-53	-59	-40
Medium Box (300-700 Cfm)	-27	-29	-40	-51	-53	-39
Large Box (>700 Cfm)	-29	-30	-41	-51	-52	-39

Notes:
1. Subtract from terminal unit sound power to determine discharge sound pressure in the space.
2. NC Values are calculated using current Industry Standard AHRI 885-2008.
3. Application ratings are outside the scope of the Certification Program.

Table 47. AHRI 885-2008 radiated transfer function assumptions

	Octave Band					
	2	3	4	5	6	7
Type 2- Mineral Fiber Insulation	-18	-19	-20	-26	-31	-36
Total dB reduction	-18	-19	-20	-26	-31	-36

Notes:
1. Subtract from terminal unit sound power to determine discharge sound pressure in the space.
2. NC Values are calculated using current Industry Standard AHRI 885-2008. Radiated Transfer Function obtained from Appendix E, Type 2 Mineral Fiber Insulation.
3. Application ratings are outside the scope of the Certification Program.

Table 48. Cabinet lining appurtenance effects (fan noise and valve noise)

Fan	Discharge Sound Effect(a) (dB)						Radiated Sound Effect(a) (dB)					
	2	3	4	5	6	7	2	3	4	5	6	7
Solid double-wall												
DS02	10	7	16	15	12	14	1	1	1	1	9	16
Closed-cell insulation												
DS02	4	5	5	5	7	7	3	6	4	1	3	2

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Application ratings are outside the scope of the certification program.

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.

Table 49. Heating coil appurtenance effects

Fan	Discharge Sound Effect[a] (dB)						Radiated Sound Effect[a] (dB)					
	2	3	4	5	6	7	2	3	4	5	6	7
Hot Water Coil[b]												
DS02	0	-1	-2	-2	-2	-2	1	1	1	1	1	2
Electric Heat[b]												
DS02	-3	-2	-4	-4	-6	-6	1	1	1	1	0	-1

Notes:

1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Application ratings are outside the scope of the certification program.

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
(b) Radiated effect applies to “fan only” sound only. Do not apply to fan + valve sound.

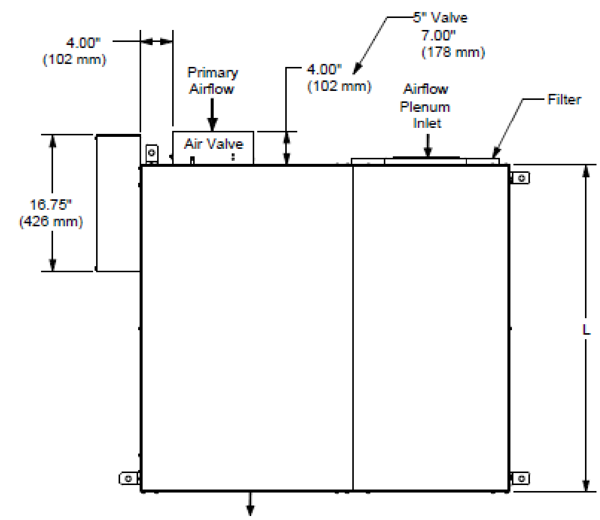
Dimensional Data

Parallel Fan-Powered Terminal Units

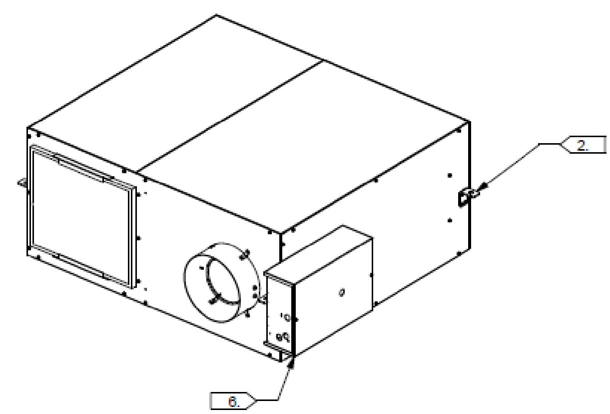
Figure 20. Parallel — cooling only (VPCG)

PARALLEL COOLING ONLY (VPCG)

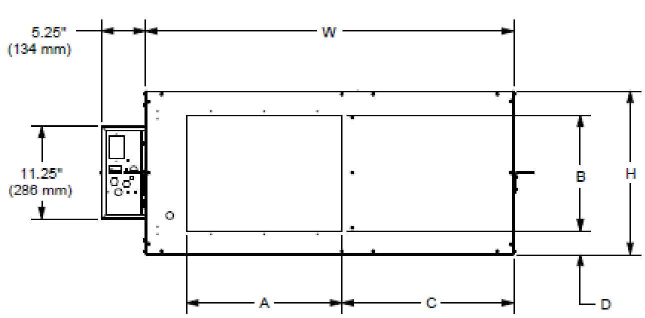
FAN SIZE	INLET SIZE AVAILABILTY		H	W	L	DISCHARGE DIMENSIONS		C	D	Max Unit Wt Lbs (kg)
	NOMINAL Ø (INCHES)	NOMINAL Ø (mm)				A	B			
SMALL	5, 6, 8, 10	127,153,204,254	17.50" (445 mm)	35.50" (902 mm)	40.00" (1016 mm)	11.50" (293 mm)	14.25" (362 mm)	19.75" (502 mm)	1.75" (45 mm)	120 (55)
MEDIUM	6, 8, 10, 12, 14	153,204,254,305,356	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	19.00" (483 mm)	14.25" (362 mm)	21.00" (534 mm)	2.75" (70 mm)	168 (77)
LARGE	8, 10, 12, 14, 16	204,254,305,356,406	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	19.00" (483 mm)	14.25" (362 mm)	21.00" (534 mm)	2.75" (70 mm)	183 (84)



TOP VIEW



FAN SIZE	FILTER SIZE
SMALL	16" x 18" (406 mm x 458 mm)
MEDIUM	16" x 18" (406 mm x 458 mm)
LARGE	16" x 18" (406 mm x 458 mm)



DISCHARGE VIEW

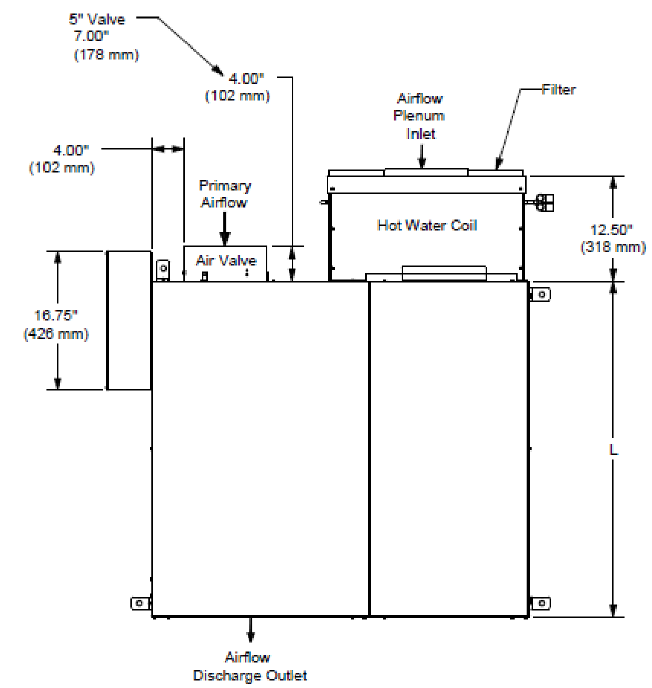
CUSTOMER NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See Installation Documents for exact hanger bracket location.
3. For motor access, remove top or bottom panel.
4. Air valve centered between top and bottom panel.
5. All high & low voltage controls have same-side NEC jumpback clearance.
6. Control box enclosure provided with all control types. Actuator, controller, and fan controls located in this area.
7. Left-hand unit shown. Rotate unit 180˚to make right-hand.
8. Weights are an estimation and will vary based on selected options.

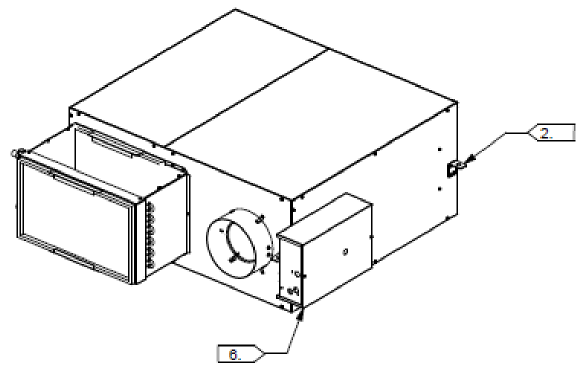
Figure 21. Parallel — hot water on inlet (VPWG)

PARALLEL WITH HOT WATER ON INLET (VPWG)

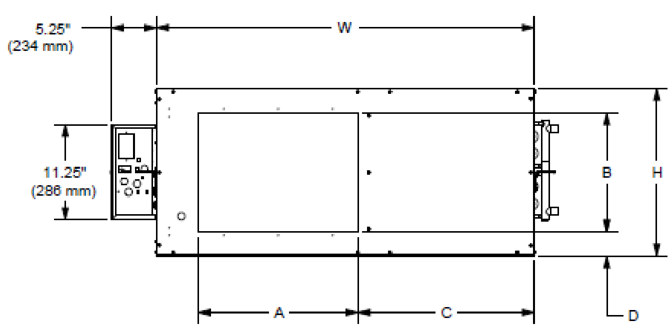
FAN SIZE	INLET SIZE AVAILABILTY		H	W	L	DISCHARGE DIMENSIONS		C	D	Max Unit Wt Lbs (kg)
	NOMINAL Ø (INCHES)	NOMINAL Ø (mm)				A	B			
SMALL	5, 6, 8, 10	127,153,204,254	17.50" (445 mm)	35.50" (902 mm)	40.00" (1016 mm)	11.50" (293 mm)	14.25" (362 mm)	19.75" (502 mm)	1.75" (45 mm)	120* (55)
MEDIUM	6, 8, 10, 12, 14	153,204,254,305,356	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	19.00" (483 mm)	14.25" (362 mm)	21.00" (534 mm)	2.75" (70 mm)	168* (77)
LARGE	8, 10, 12, 14, 16	204,254,305,356,406	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	19.00" (483 mm)	14.25" (362 mm)	21.00" (534 mm)	2.75" (70 mm)	183* (84)



TOP VIEW



FAN SIZE	FILTER SIZE
SMALL	14" x 16" (356 mm x 406 mm)
MEDIUM	14" x 23" (356 mm x 584 mm)
LARGE	14" x 23" (356 mm x 584 mm)



DISCHARGE VIEW

CUSTOMER NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.

2. See Installation Documents for exact hanger bracket location.

3. For motor access, remove top or bottom panel.

4. Air valve centered between top and bottom panel.

5. All high & low voltage controls have same-side NEC jumpback clearance.

6. Control box enclosure provided with all control types. Actuator, controller, and fan controls located in this area.

7. Left-hand unit shown. Rotate unit 180° to make right-hand.

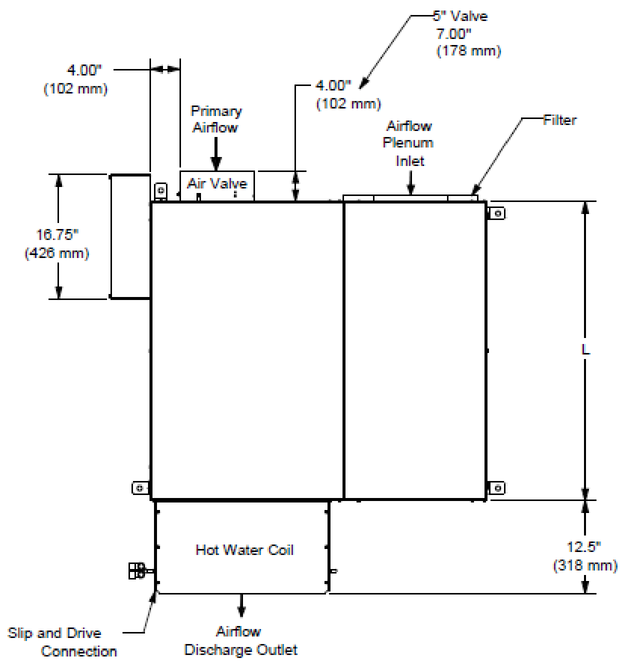
8. Weights are an estimation and will vary based on selected options.

* Unit Weight does not include coil.

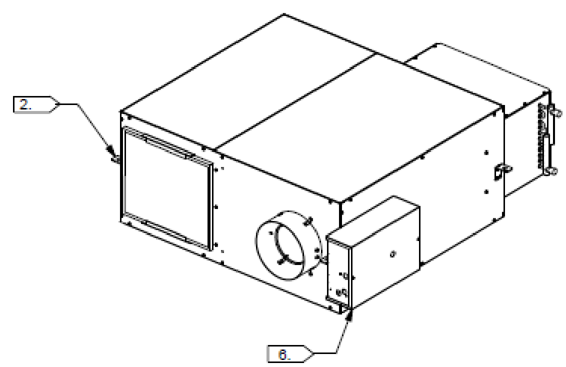
Figure 22. Parallel — hot water on discharge (VPWG)

PARALLEL WITH HOT WATER ON DISCHARGE (VPWG)

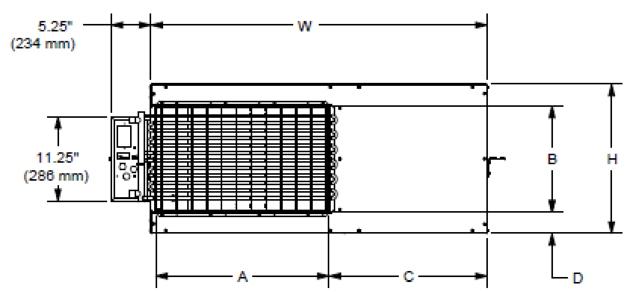
FAN SIZE	INLET SIZE AVAILABILTY		H	W	L	DISCHARGE DIMENSIONS		C	D	Max Unit Wt Lbs (kg)
	NOMINAL Ø (INCHES)	NOMINAL Ø (mm)				A	B			
SMALL	5, 6, 8, 10	127,153,204,254	17.50" (445 mm)	35.50" (902 mm)	40.00" (1016 mm)	16.75" (426 mm)	14.25" (362 mm)	18.25" (464 mm)	1.75" (45 mm)	120* (55)
MEDIUM	6, 8, 10, 12, 14	153,204,254,305,356	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	23.25" (591 mm)	14.25" (362 mm)	21.25" (540 mm)	3.00" (77 mm)	168* (77)
LARGE	8, 10, 12, 14, 16	204,254,305,356,406	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	23.25" (591 mm)	14.25" (362 mm)	21.25" (540 mm)	3.00" (77 mm)	183* (84)



TOP VIEW



FAN SIZE	FILTER SIZE
SMALL	16" x 18" (406 mm x 458 mm)
MEDIUM	16" x 18" (406 mm x 458 mm)
LARGE	16" x 18" (406 mm x 458 mm)



DISCHARGE VIEW

CUSTOMER NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.

2. See Installation Documents for exact hanger bracket location.

3. For motor access, remove top or bottom panel.

4. Air valve centered between top and bottom panel.

5. All high & low voltage controls have same-side NEC jumpback clearance.

6. Control box enclosure provided with all control types. Actuator, controller, and fan controls located in this area.

7. Left-hand unit shown. Rotate unit 180° to make right-hand.

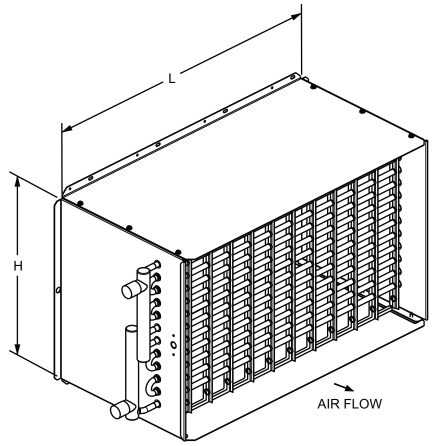
8. Weights are an estimation and will vary based on selected options.

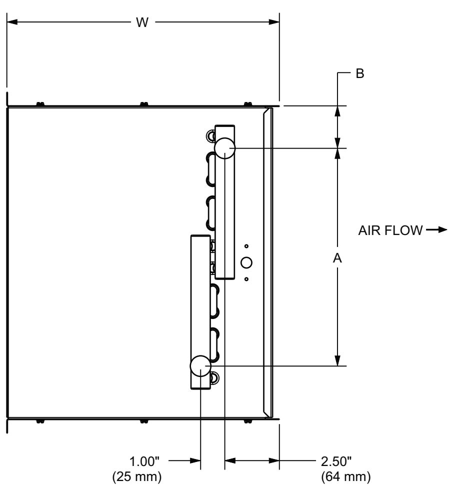
* Unit Weight does not include coil.

Figure 23. Parallel coil assembly (1-row)

COIL INFORMATION FOR PARALLEL 1-ROW COILS

COIL INFORMATION FOR PARALLEL COIL ASSEMBLY						
FAN SIZE	COIL CONNECTION 1 ROW O.D.	A	B	L	H	W
SMALL	0.875" (22 mm)	10.00" (254 mm)	2.00" (51 mm)	16.75" (426 mm)	14.25" (362 mm)	12.50" (318 mm)
MEDIUM	0.875" (22 mm)	10.00" (254 mm)	2.00" (51 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)
LARGE	0.875" (22 mm)	10.00" (254 mm)	2.00" (51 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)





HEADER SIDE VIEW

FAN SIZE	INTERNAL VOLUME GAL (in. 3)	OPERATING WEIGHT lbs (kg)
SMALL	.11 (25.4)	13.4 (6.1)
MEDIUM	.14 (32.3)	15.6 (7.1)
LARGE	.14 (32.3)	15.6 (7.1)

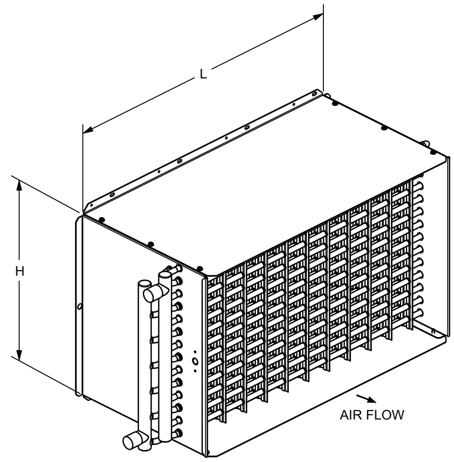
CUSTOMER NOTE:

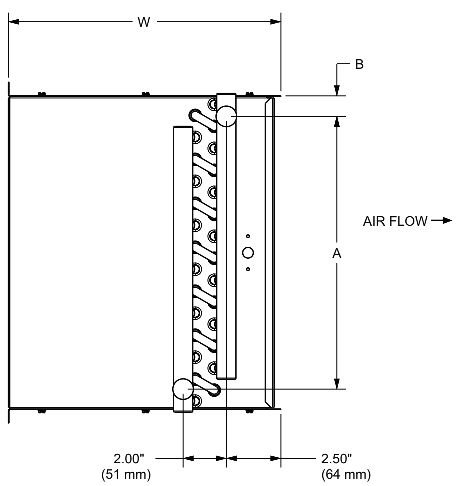
1. Location of coil connections is determined by facing air stream. Left-hand coil connections shown, Right-hand opposite.
2. Coil furnished with stub sweat connections.
3. Use port at bottom for inlet and top for outlet on single row coils. Water inlet always on the downstream side of the hot water coil. Water outlet always on the upstream side of the hot water coil.
4. Coil height and width is dependent upon unit height and width.

Figure 24. Parallel coil assembly (2-row)

COIL INFORMATION FOR PARALLEL 2-ROW COILS

COIL INFORMATION FOR PARALLEL COIL ASSEMBLY						
FAN SIZE	COIL CONNECTION 2 ROW O.D.	A	B	L	H	W
SMALL	0.875" (22 mm)	12.50" (318 mm)	1.00" (25 mm)	16.75" (426 mm)	14.25" (362 mm)	12.50" (318 mm)
MEDIUM	0.875" (22 mm)	12.50" (318 mm)	1.00" (25 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)
LARGE	0.875" (22 mm)	12.50" (318 mm)	1.00" (25 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)





HEADER SIDE VIEW

FAN SIZE	INTERNAL VOLUME GAL (in. ^{3})	OPERATING WEIGHT lbs (kg)
SMALL	.25 (58.6)	17.2 (7.8)
MEDIUM	.33 (75.1)	20.4 (9.3)
LARGE	.33 (75.1)	20.4 (9.3)

CUSTOMER NOTE:

1. Location of coil connections is determined by facing air stream. Left-hand coil connections shown, Right-hand opposite.

2. Coil furnished with stub sweat connections.

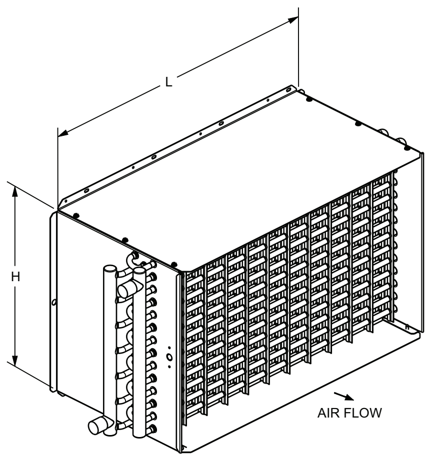
3. Use port at bottom for inlet and top for outlet on single row coils. For multirow coils, always plumb in counter flow orientation. Water inlet always on the downstream side of the hot water coil. Water outlet always on the upstream side of the hot water coil.

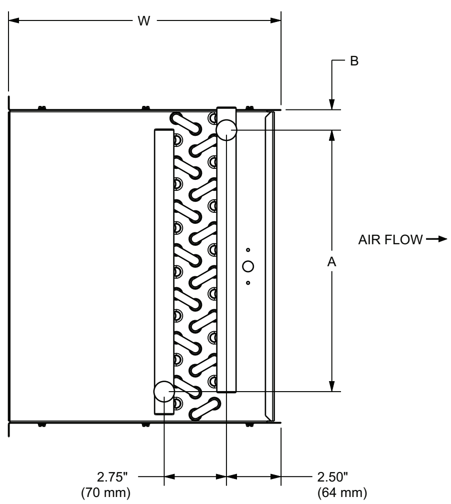
4. Coil height and width is dependent upon unit height and width.

Figure 25. Parallel coil assembly (3-row)

COIL INFORMATION FOR PARALLEL 3-ROW COILS

COIL INFORMATION FOR PARALLEL COIL ASSEMBLY						
FAN SIZE	COIL CONNECTION 3 ROW O.D.	A	B	L	H	W
SMALL	0.875" (22 mm)	12.00" (305 mm)	1.00" (25 mm)	16.75" (426 mm)	14.25" (362 mm)	12.50" (318 mm)
MEDIUM	0.875" (22 mm)	12.00" (305 mm)	1.00" (25 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)
LARGE	0.875" (22 mm)	12.00" (305 mm)	1.00" (25 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)





HEADER SIDE VIEW

FAN SIZE	INTERNAL VOLUME GAL (in. ^{3})	OPERATING WEIGHT lbs (kg)
SMALL	.37 (84.7)	20.6 (9.4)
MEDIUM	.47 (109.5)	24.8 (11.3)
LARGE	.47 (109.5)	24.8 (11.3)

CUSTOMER NOTE:

1. Location of coil connections is determined by facing air stream. Left-hand coil connections shown, Right-hand opposite.

2. Coil furnished with stub sweat connections.

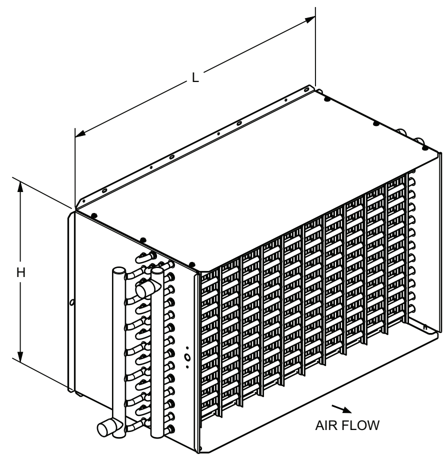
3. Use port at bottom for inlet and top for outlet on single row coils. For multirow coils, always plumb in counter flow orientation. Water inlet always on the downstream side of the hot water coil. Water outlet always on the upstream side of the hot water coil.

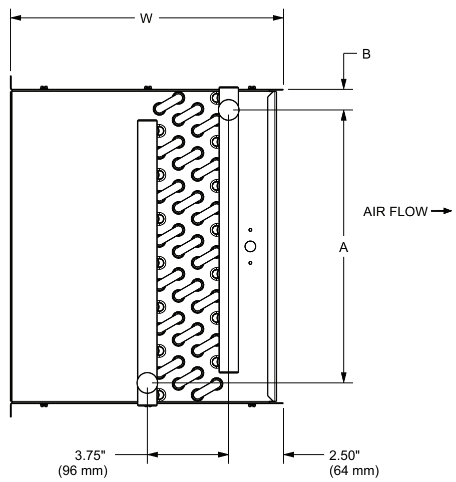
4. Coil height and width is dependent upon unit height and width.

Figure 26. Parallel coil assembly (4-row)

COIL INFORMATION FOR PARALLEL 4-ROW COILS

COIL INFORMATION FOR PARALLEL COIL ASSEMBLY						
FAN SIZE	COIL CONNECTION 4 ROW O.D.	A	B	L	H	W
SMALL	0.875" (22 mm)	12.50" (318 mm)	1.00" (25 mm)	16.75" (426 mm)	14.25" (362 mm)	12.50" (318 mm)
MEDIUM	0.875" (22 mm)	12.50" (318 mm)	1.00" (25 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)
LARGE	0.875" (22 mm)	12.50" (318 mm)	1.00" (25 mm)	23.25" (591 mm)	14.25" (362 mm)	12.50" (318 mm)





HEADER SIDE VIEW

FAN SIZE	INTERNAL VOLUME GAL (in. 3)	OPERATING WEIGHT lbs (kg)
SMALL	.48 (110.9)	24.0 (10.9)
MEDIUM	.62 (143.9)	29.1 (13.3)
LARGE	.62 (143.9)	29.1 (13.3)

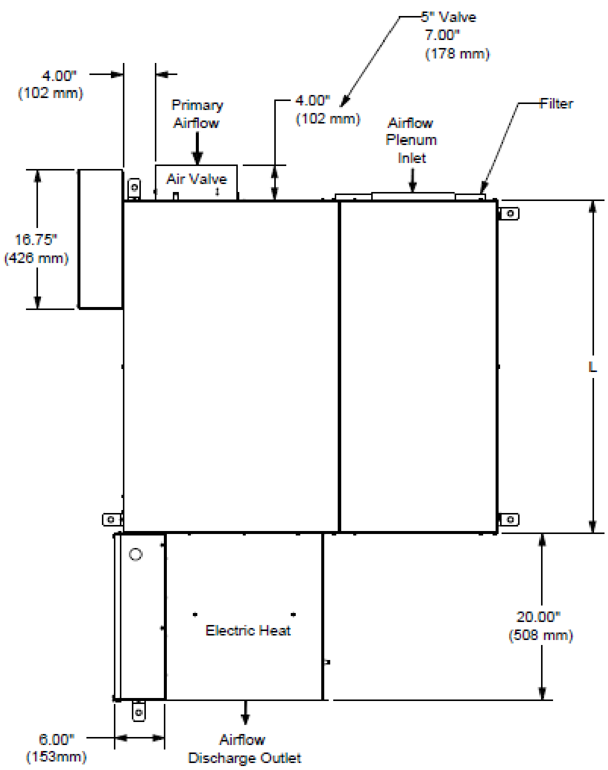
CUSTOMER NOTE:

1. Location of coil connections is determined by facing air stream. Left-hand coil connections shown, Right-hand opposite.
2. Coil furnished with stub sweat connections.
3. Use port at bottom for inlet and top for outlet on single row coils. For multirow coils, always plumb in counter flow orientation. Water inlet always on the downstream side of the hot water coil. Water outlet always on the upstream side of the hot water coil.
4. Coil height and width is dependent upon unit height and width.

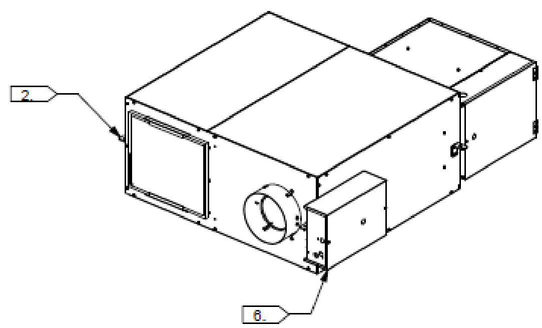
Figure 27. Parallel — electric (VPEG)

PARALLEL ELECTRIC HEAT (VPEG)

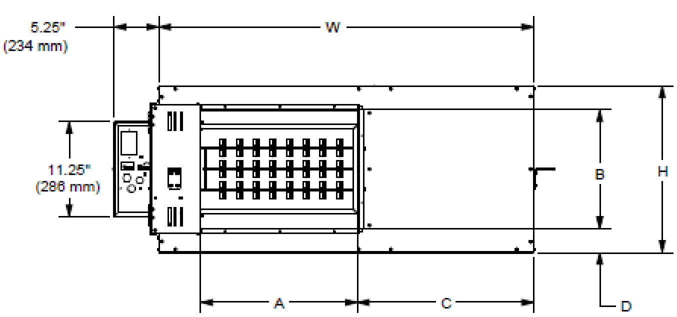
FAN SIZE	INLET SIZE AVAILABILTY		H	W	L	DISCHARGE DIMENSIONS		C	D	Max Unit Wt Lbs (kg)
	NOMINAL Ø (INCHES)	NOMINAL Ø (mm)				A	B			
SMALL	5, 6, 8, 10	127,153,204,254	17.50" (445 mm)	35.50" (902 mm)	40.00" (1016 mm)	11.50" (293 mm)	14.25" (362 mm)	19.75" (502 mm)	1.50" (39 mm)	155 (71)
MEDIUM	6, 8, 10, 12, 14	153,204,254,305,356	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	19.00" (483 mm)	14.25" (362 mm)	21.00" (534 mm)	3.00" (77 mm)	208 (95)
LARGE	8, 10, 12, 14, 16	204,254,305,356,406	20.00" (508 mm)	45.00" (1143 mm)	40.00" (1016 mm)	19.00" (483 mm)	14.25" (362 mm)	21.00" (534 mm)	3.00" (77 mm)	223 (102)



TOP VIEW



FAN SIZE	FILTER SIZE
SMALL	16" x 18" (406 mm x 458 mm)
MEDIUM	16" x 18" (406 mm x 458 mm)
LARGE	16" x 18" (406 mm x 458 mm)



DISCHARGE VIEW

CUSTOMER NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See Installation Documents for exact hanger bracket location.
3. For motor access, remove top or bottom panel.
4. Air valve centered between top and bottom panel.
5. All high & low voltage controls have same-side NEC jumpback clearance.
6. Control box enclosure provided with all control types. Actuator, controller, and fan controls located in this area.
7. Left-hand unit shown. Rotate unit 180̊ to make right-hand.
8. Weights are an estimation and will vary based on selected options.

Low-Height Parallel Fan-Powered Terminal Units

Table 50. Low height parallel general and dimensional data — DS02

Description	Units	Cooling Only	Hot Water	Electric Heat
		LPCF	LPWF	LPEF
Filter Size	in	9 x18x1	9 x18x1	9 x18x1
	mm	229x457x25	229x457x25	229x457x25
Inlet Size Availability	in	5, 6, 8, 8x14	5, 6, 8, 8x14	5, 6, 8, 8x14
	mm	127, 152, 203, 203x355	127, 152, 203, 203x355	127, 152, 203, 203x355
Unit Weight	lb	92	98	110
	kg	42	44	50
Height (H)	in	10.5	10.5	10.5
	mm	267	267	267
Width (W)	in	40	40	40
	mm	1016	1016	1016
Length (L)	in	35	35	35
	mm	889	889	889
Discharge (A)	in	18	18	14
	mm	457	457	365
Discharge (B)	in	10	10	9
	mm	254	254	229

Figure 28. Low-height parallel — cooling only (LPCF)

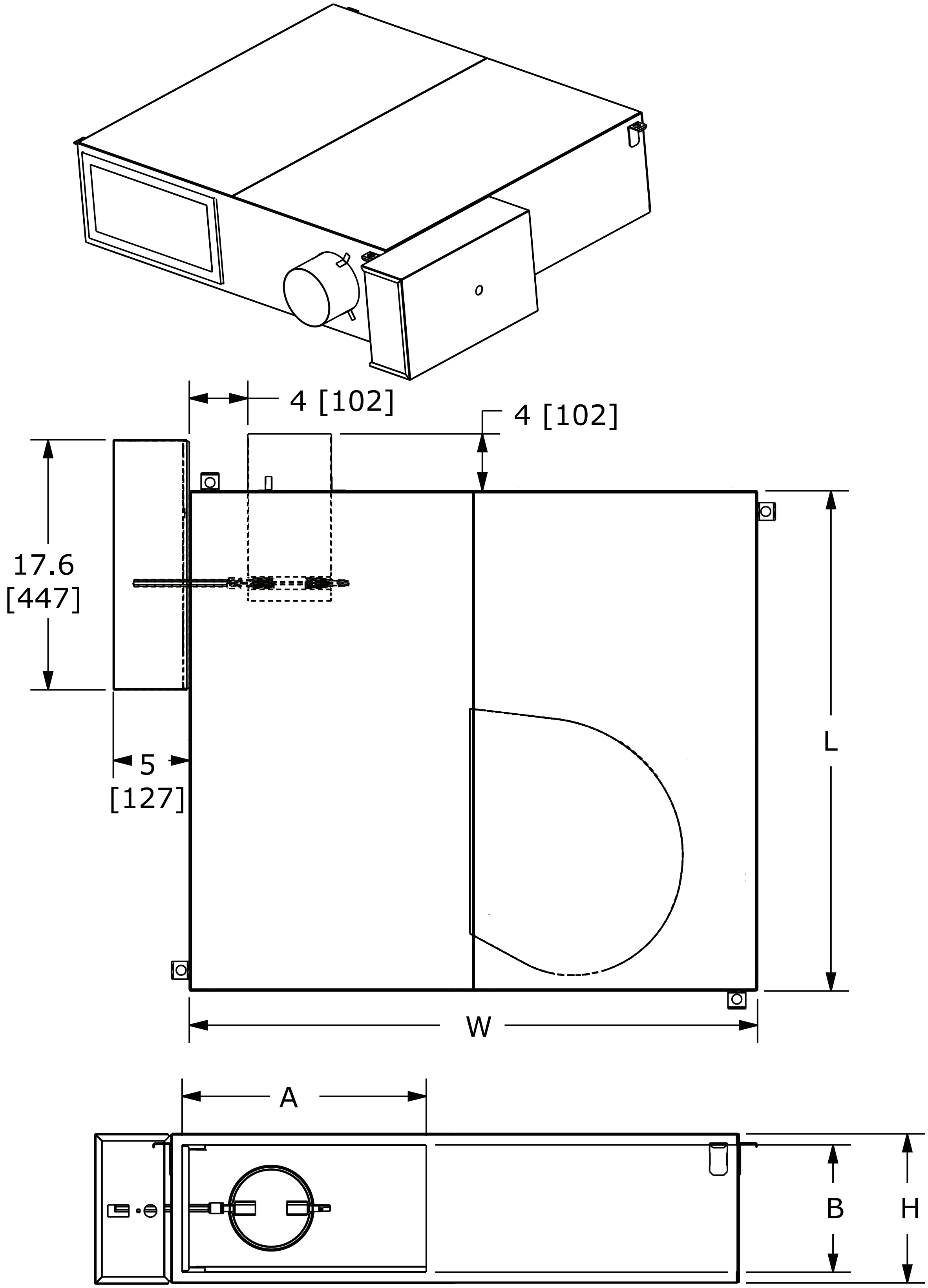
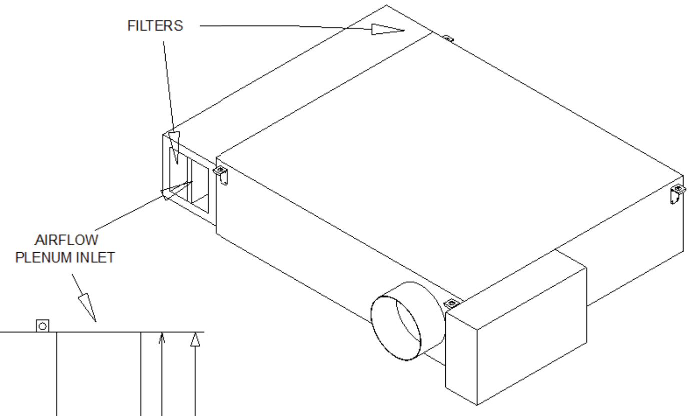
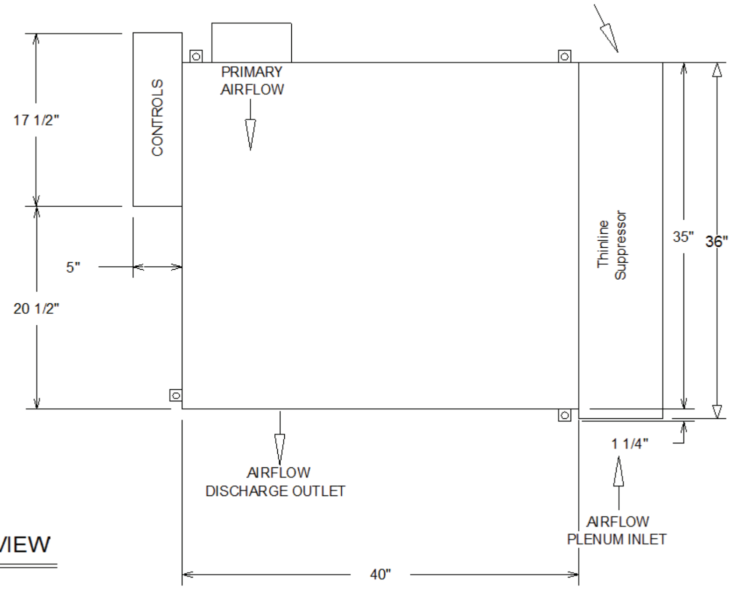


Figure 29. Low-height parallel — cooling only (LPCF) with thinline suppressor

Unit Size	LPCF08DS02
Nominal Valve Size & Depth	8" Dia. x 4" Depth
Nominal Fan Size	DS02 Fan
Filter Size	7" x 7" x 1"

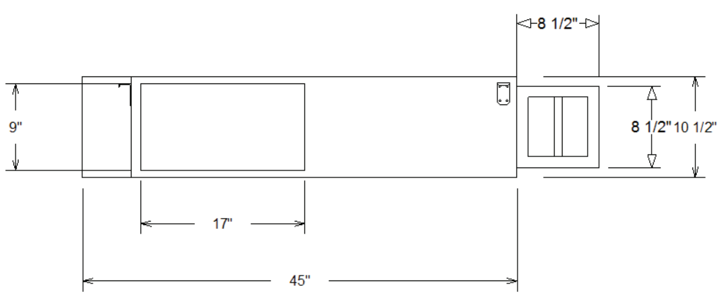




TOP VIEW

NOTES:

1. Allow a minimum 6" plenum inlet clearance for un-ducted installations.
2. Flanged discharge outlet accepts up to a 1" duct flange.
3. Filter is secured in filter frame located in unit inlet.
4. Bottom access panel standard.
5. Hanger Bracket flange on unit adds 1 1/4" to each side of the unit.
6. Air valve centered between top & bottom panel.
7. All high & low voltage controls have same-side NEC jumpback clearance.



DISCHARGE VIEW

Approximate Dry Weight	105.0 lb

Weights reflected may vary ±5.0 lb based upon options selected.

Figure 30. Low-height parallel — hot water (LPWF)

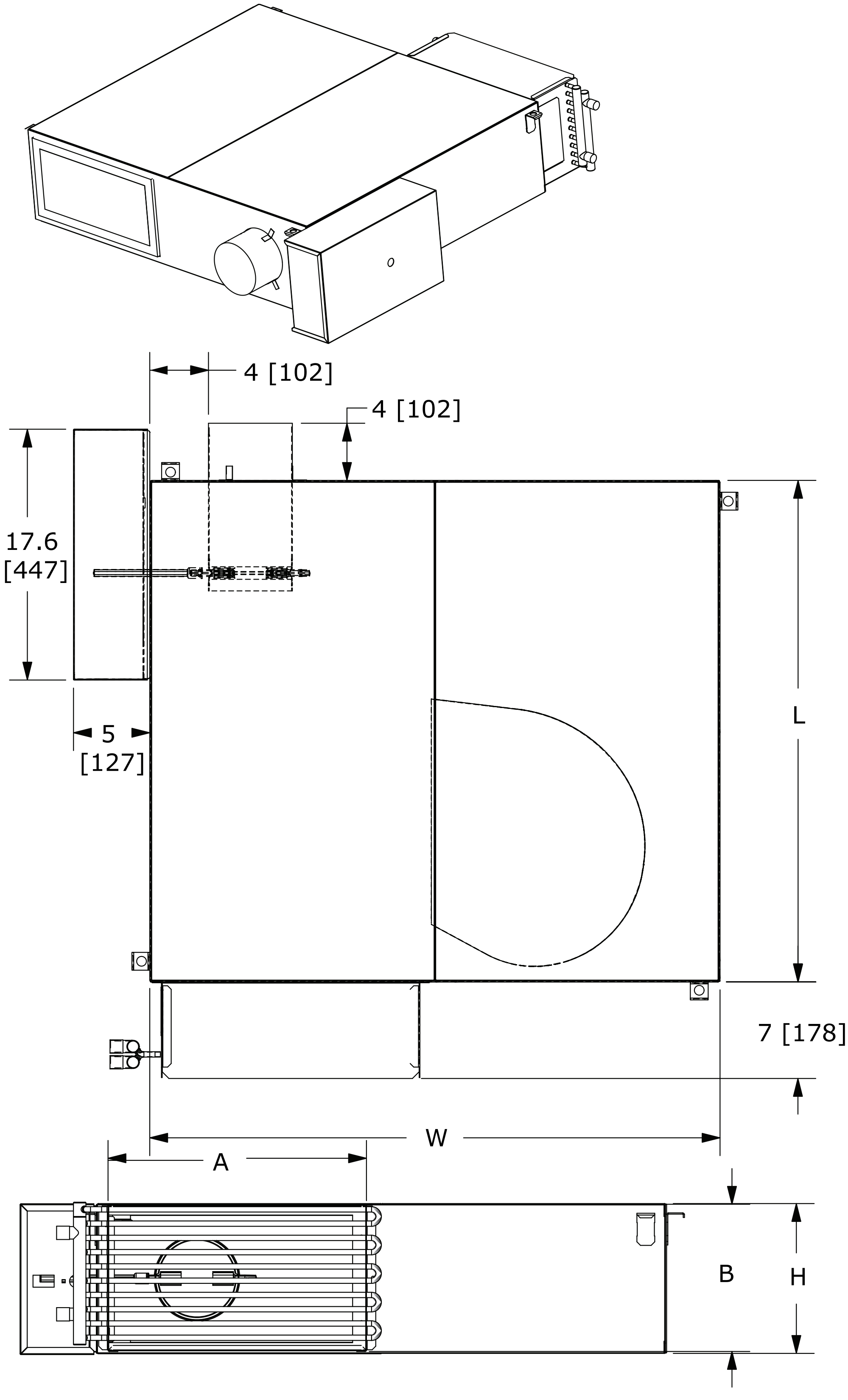
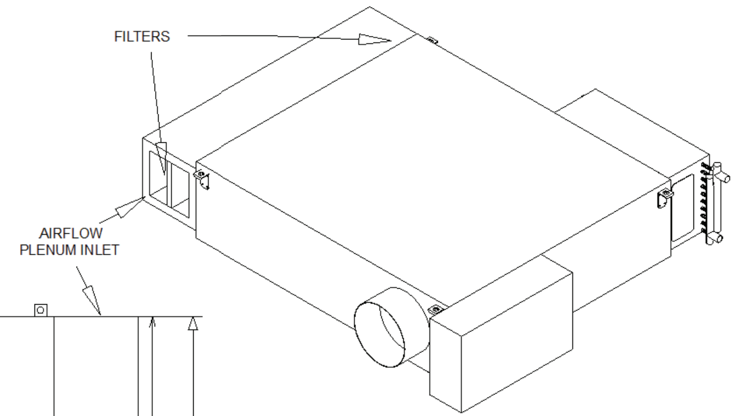
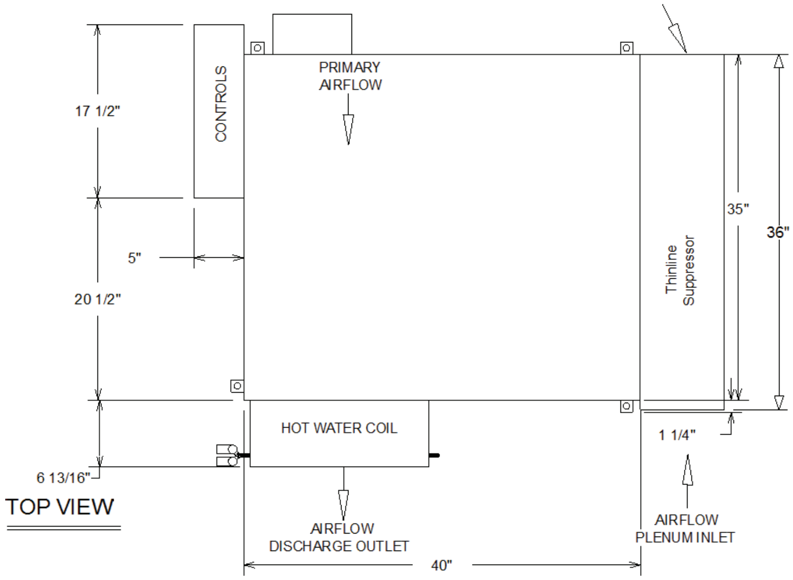


Figure 31. Low-height parallel — hot water (LPWF) with thinline suppressor

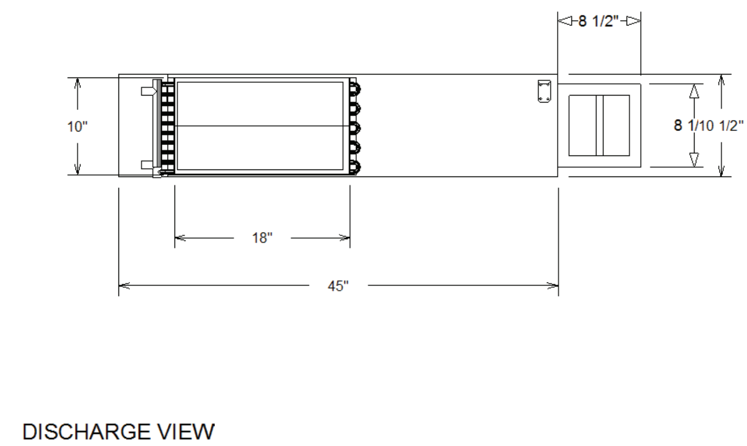
Unit Size	LPWF08DS02
Nominal Valve Size & Depth	8" Dia. x 4" Depth
Nominal Fan Size	DS02 Fan
Filter Size	7" x 7" x 1"





NOTES:

1. Allow a minimum 6" plenum inlet clearance for un-ducted installations.
2. Filter is secured in filter frame located in unit inlet.
3. Bottom access panel standard.
4. Hanger Bracket flange on unit adds 1 1/4" to each side of the unit.
5. Air valve centered between top & bottom panel.
6. Coils are provided without internal insulation. If the unit is to be installed in a location with high humidity, external insulation around the heating coil should be installed as required.
7. All high & low voltage controls have same-side NEC jumpback clearance.
8. Coil furnished with 7/8" O.D. stub sweat connections.
9. Left hand and right hand coil connections are available by rotating the coil 180 degrees. Access panel in coil provided.



Approximate Dry Weight	111.0 lb

Weights reflected may vary ±5.0 lb based upon options selected.

Figure 32. Low-height parallel — electric (LPEF)

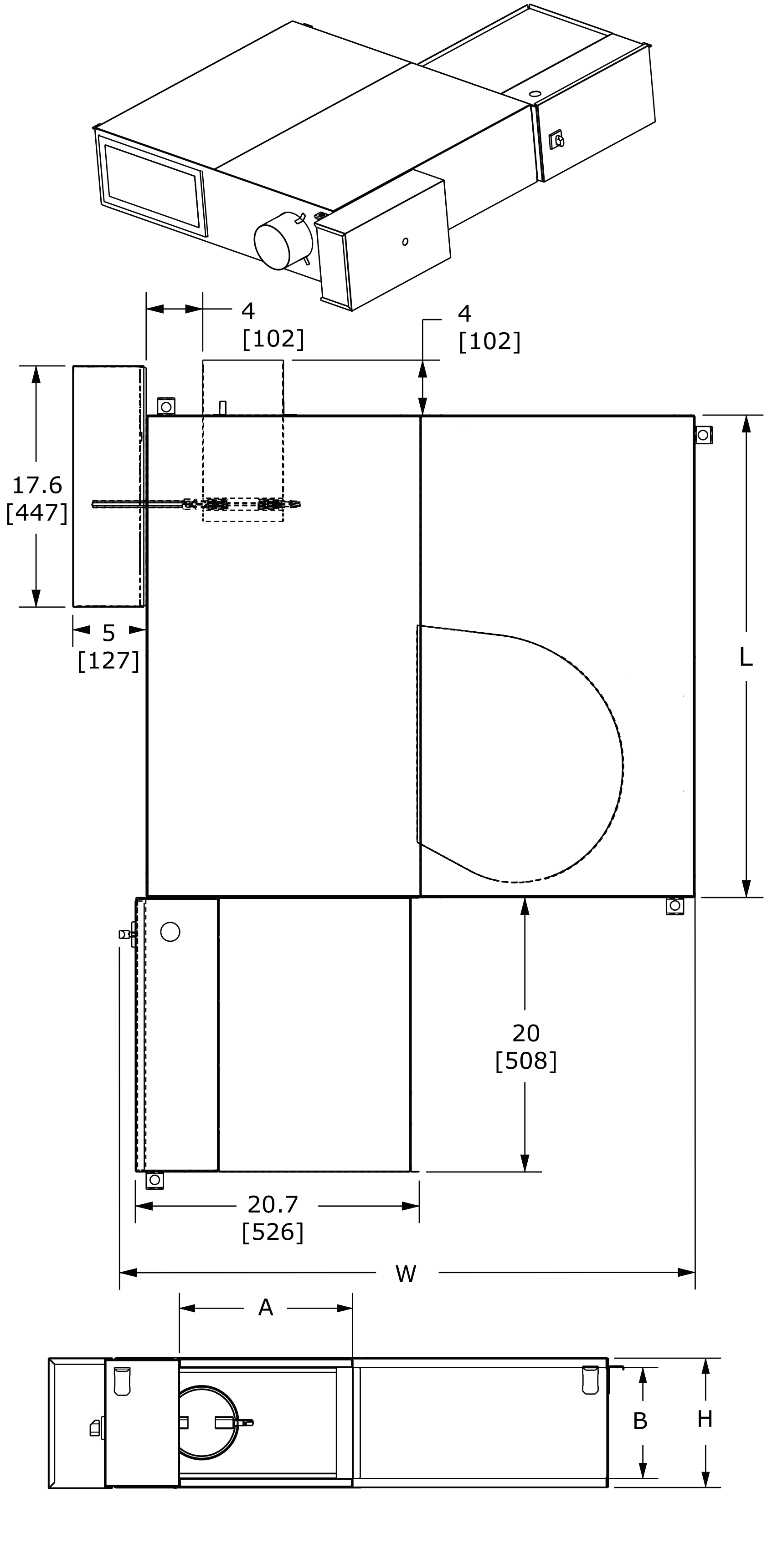
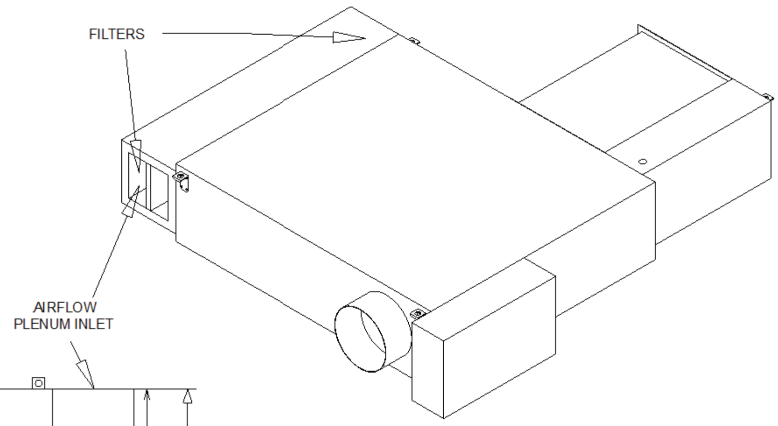
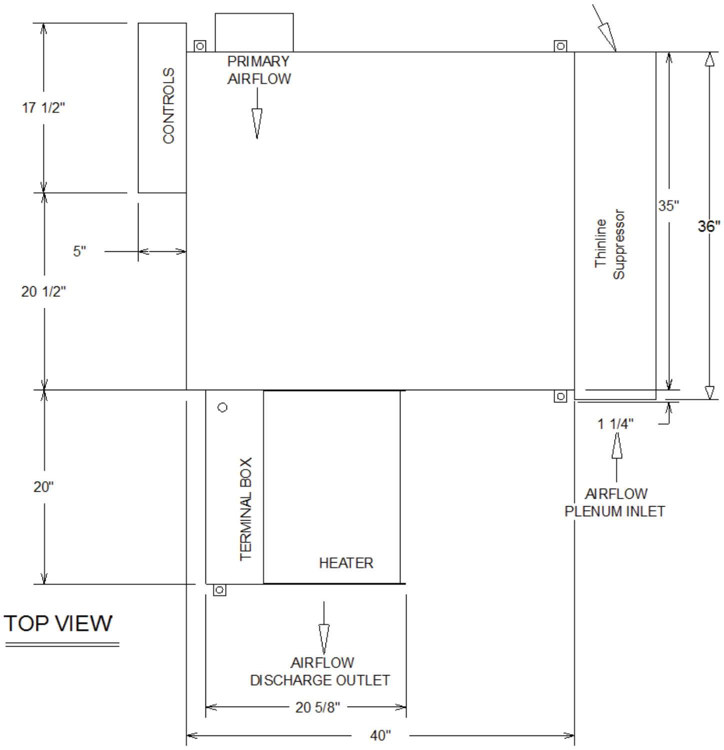


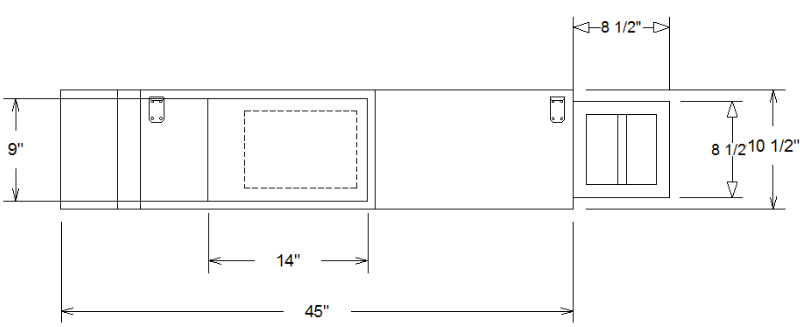
Figure 33. Low-height parallel — electric (LPEF) with thinline suppressor

Unit Size	LPEF08DS02
Nominal Valve Size & Depth	8" Dia. x 4" Depth
Nominal Fan Size	DS02 Fan
Filter Size	7" x 7" x 1"





TOP VIEW



DISCHARGE VIEW

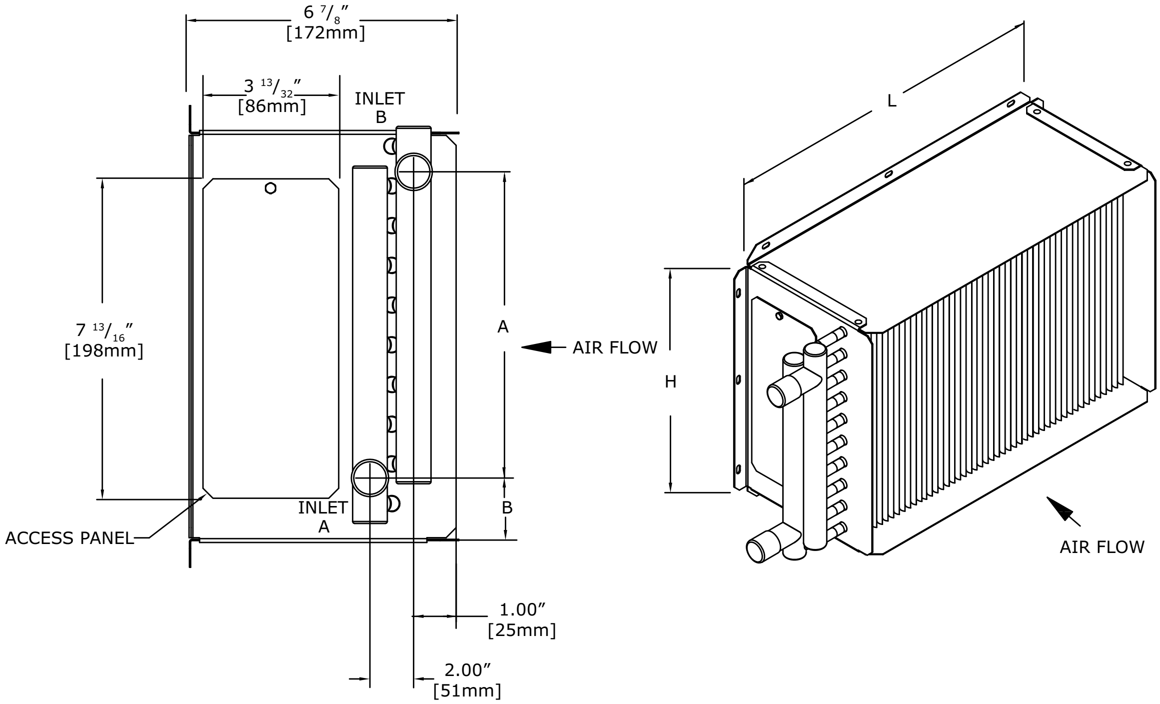
NOTES:

1. Allow a minimum 6" plenum inlet clearance for un-ducted installations.
2. Flanged discharge outlet accepts up to a 1" duct flange.
3. Filter is secured in filter frame located in unit inlet.
4. Bottom access panel standard.
5. Air valve centered between top & bottom panel.
6. Hanger Bracket flange on unit adds 1 1/4" to each side of the unit.
7. Heating coil un-insulated. External insulation may be field supplied and installed as required.
8. All high & low voltage controls have same-side NEC jumpback clearance.
9. Allow 48" of straight duct downstream of unit before first runout and inside of the duct should be equal discharge size.
10. Terminal box access door is side hinged. Allow for clearance.

Approximate Dry Weight	123.0 lb

Weights reflected may vary ±5.0 lb based upon options selected.

Figure 34. Low-height parallel coil assembly (1 row)

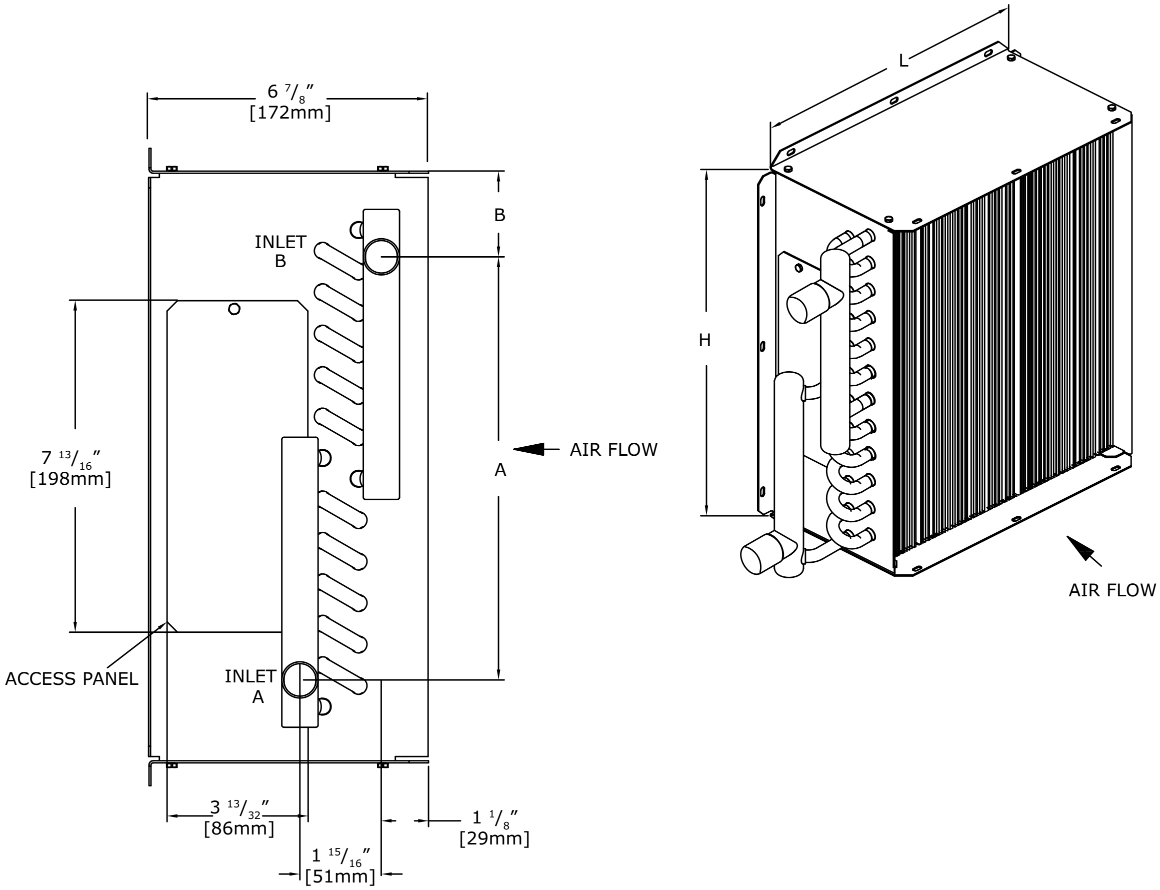


Fan Size	Coil Connection (O. D.) in (mm)	A in (mm)	B in (mm)	L in (mm)	H in (mm)	Internal Volume gal (in^3)	Operating Weight lb (kg)
DS02	0.875 (22)	7.75 (197)	1.50 (38)	18.00 (457)	10.00 (254)	0.07 (17.02)	10.4 (4.7)

Notes:

1. *Location of coil connections is determined by facing air stream. R.H. Coil connections shown, L.H. not available.*
2. *Coil furnished with stub sweat connections.*
3. *Access Panel is standard.*

Figure 35. Low-height parallel coil assembly (2 row)

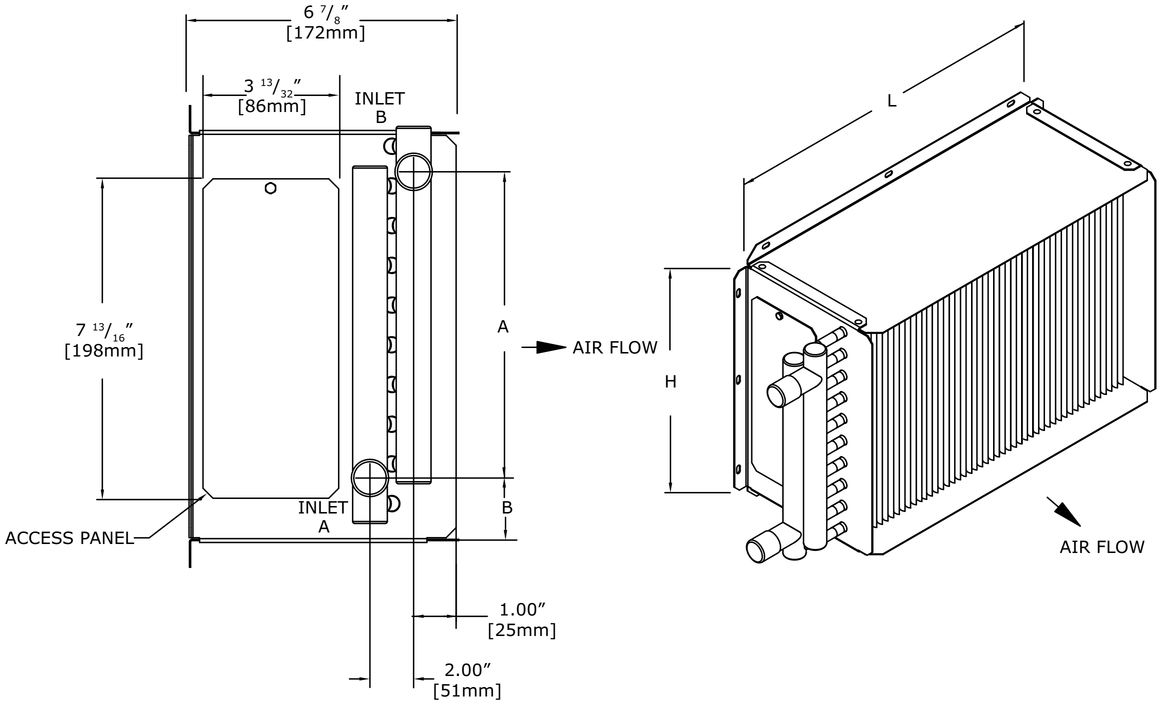


Fan Size	Coil Connection (O. D.) in (mm)	A in (mm)	B in (mm)	L in (mm)	H in (mm)	Internal Volume gal (in³)	Operating Weight lb (kg)
DS02	0.875 (22)	6.25 (159)	1.50 (38)	18.00 (457)	10.00 (254)	0.10 (23.88)	7.8 (3.5)

Notes:

1. *Location of coil connections is determined by facing air stream. R.H. Coil connections shown, L.H. not available.*
2. *Coil furnished with stub sweat connections.*
3. *Access Panel is standard.*

Figure 36. Low-height parallel discharge water coil assembly (1 row)

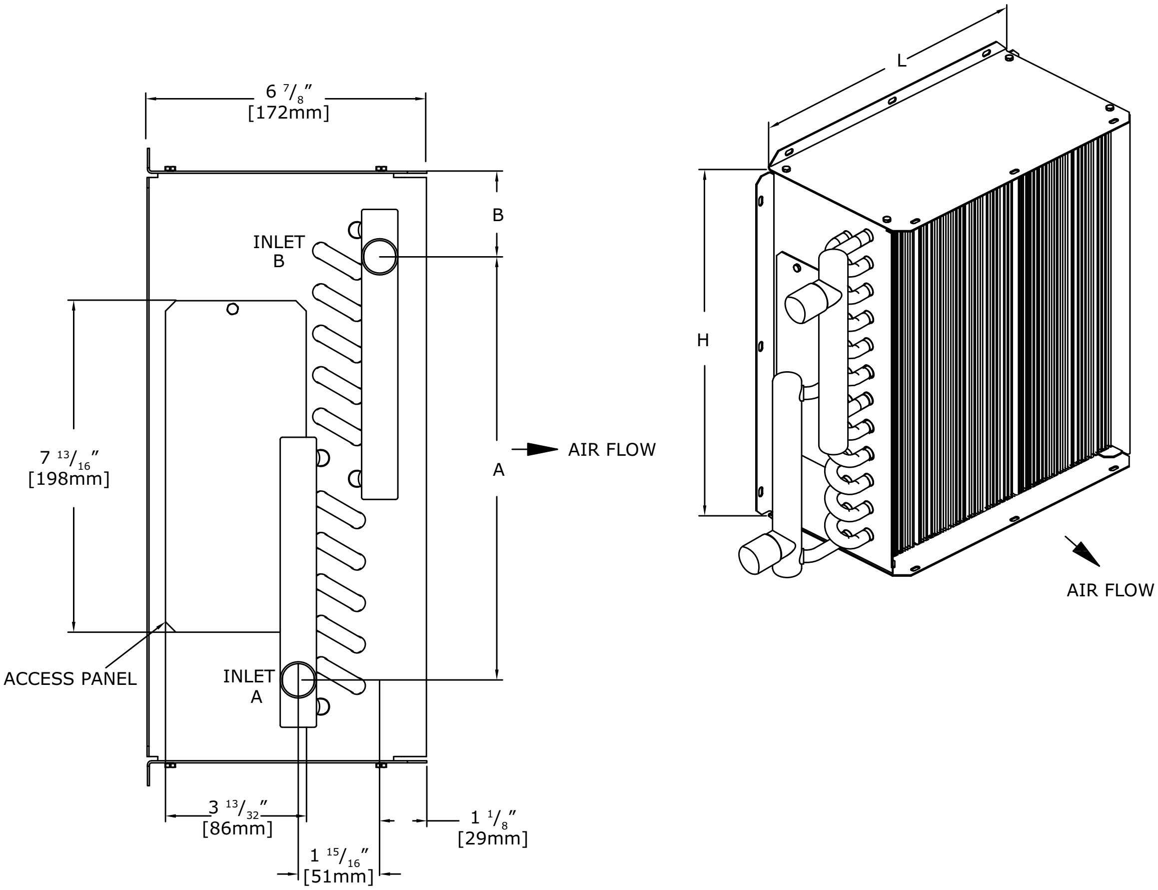


Fan Size	Coil Connection (O. D.) in (mm)	A in (mm)	B in (mm)	L in (mm)	H in (mm)	Internal Volume gal (in^3)	Operating Weight lb (kg)
DS02	0.875 (22)	7.75 (197)	1.50 (38)	18.00 (457)	10.00 (254)	0.07 (17.02)	10.4 (4.7)

Notes:

1. *Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.*
2. *Coil furnished with stub sweat connections.*
3. *Coil is rotated to achieve opposite hand connection. Water inlet is always on the bottom and outlet on the top.*
4. *Access Panel is standard.*

Figure 37. Low-height parallel discharge water coil assembly (2 row)



Fan Size	Coil Connection (O. D.) in (mm)	A in (mm)	B in (mm)	L in (mm)	H in (mm)	Internal Volume gal (in³)	Operating Weight lb (kg)
DS02	0.875 (22)	6.25 (159)	1.50 (38)	18.00 (457)	10.00 (254)	0.10 (23.88)	7.8 (3.5)

Notes:

1. *Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.*
2. *Coil furnished with stub sweat connections.*
3. *Use port at bottom for inlet and port at top for outlet. For 2–row coils, always plumb in counter flow orientation: Left hand unit's water inlet on bottom, and outlet on the top. Right hand unit's water inlet on top and outlet on the bottom.*
4. *Access Panel is standard.*

Mechanical Specifications: Fan-Powered

Casing

22-gauge galvanized steel casing construction. Hanger brackets, top and bottom access, and plenum filter are provided as standard.

Agency Listing

Unit is UL and Canadian UL Listed as a room air terminal unit. Control # 9N65. AHRI 880 Certified.

UL-Listed Products

All VariTrane™ Units are listed in accordance with UL as terminal units. This listing includes the terminal with electric heaters. Additionally, all insulation materials pass UL 25/50 smoke and flame safety standards.

AHRI Certified Performance

All VariTrane™ units are AHRI certified. AHRI 880 guarantees the pressure drop, flow performance, and acoustical performance provided is reliable and has been tested in accordance with industry accepted standards. AHRI 885 uses AHRI 880 performance and applies accepted industry methods to estimate expected **NC** sound levels within the occupied space.

Insulation

1–inch (25.4 mm) Matte-faced Insulation — Interior surface of unit casing is acoustically and thermally lined with 1-inch, 1.8lb/ ft^3 (25.4 mm, 16.0 kg/m^3) composite density glass fiber with a high-density facing. Insulation R-Value is 4.2. Insulation is UL listed and meets NFPA-90A and UL 181 standards. There are no exposed edges of insulation (complete metal encapsulation).

1–inch (25.4 mm) Foil-faced Insulation — Interior surface of unit casing is acoustically and thermally lined with 1-inch, 1.8lb/ ft^3 (25.4 mm, 16.0 kg/m^3) density glass fiber with foil facing. Insulation R-Value is 4.2. Insulation is UL listed and meets NFPA-90A and UL 181 standards and bacteriological standard ASTM C 665. There are no exposed edges of insulation (complete metal encapsulation).

1–inch (25.4 mm) Double-wall Insulation — Interior surface of unit casing is acoustically and thermally lined with a 1-inch, 1.8lb./ft^3 (25.4 mm, 16.0 kg/m^3) composite density glass fiber with high-density facing. Insulation R-value is 4.2. Insulation is UL listed and meets NFPA-90A and UL 181 standards. Insulation is covered by interior liner made of 26-gage galvanized steel. All wire penetrations are covered by grommets. There are no exposed edges of insulation (complete metal encapsulation).

3/8–inch (9.5 mm) Closed-cell Insulation — Interior surface of the unit casing is acoustically and thermally lined with 3/8-inch, 4.4 lb/ft^3 (9.5 mm, 70.0 kg/m^3) closed-cell insulation. Insulation is UL listed and meets NFPA-90A and UL 181 standards. Insulation has an R-Value of 1.5. There are no exposed edges of insulation (complete metal encapsulation).

Primary Air Valve

Air Valve Round — The primary (ventilation) air inlet connection is an 18-gauge galvanized steel cylinder sized to fit standard round duct. A multiple-point, averaging flow sensing ring is provided with balancing taps for measuring +/-5% of unit cataloged airflow. An airflow-versus-pressure differential calibration chart is provided. The damper blade is constructed of a closed-cell foam seal that is mechanically locked between two 22-gauge galvanized steel disks. The damper blade assembly is connected to a cast zinc shaft supported by self-lubricating bearings. The shaft is cast with a damper position indicator. The valve assembly includes a mechanical stop to prevent over-stroking.

Air Valve Rectangular — Inlet collar is constructed of 18-gauge galvanized steel sized to fit standard rectangular duct. An integral multiple-point, averaging flow-sensing ring provides primary airflow measurement within +/-5% of unit cataloged airflow. Damper is 16-gauge galvanized steel. The damper blade assembly is connected to a cast zinc shaft supported by self-lubricating bearings. The shaft is cast with a damper position indicator. The valve assembly includes a mechanical stop to prevent over-stroking.

Table 51. Unit/inlet combinations — VPxG

Unit	5	6	8	10	12	14	16
Small	X	X	X	X	X		
Medium		X	X	X	X	X	
Large			X	X	X	X	X

Table 52. Fan/inlet combinations — low height

Inlet (in.)	LPxF
	DS02
4	
5	X
6	X
8	X
10	
8 x 14	X

Fan Motor

PSC

Single-speed, direct-drive, permanent split capacitor type. Thermal overload protection provided. Motors will be designed specifically for use with an open SCR. Motors will accommodate anti-backward rotation at start-up. Motor and fan assembly are isolated from terminal unit.

ECM

Electrically commutated motor (ECM) is designed for high-efficient operation with over 70% efficiency throughout the operating range. .

Fan Speed Control

Variable Speed Control Switch (SCR)

The SCR speed control device is provided as standard and allows the operator infinite fan speed adjustment.

Transformer

The transformer is factory installed in the fan control box to provide 24 Vac for controls.

Disconnect Switch

A toggle on/off switch is provided as standard and allows the operator to turn the unit on or off by toggling to the appropriate setting. This switch breaks both legs of power to the fan and the electronic controls (if applicable).

Filter

A 1-inch (25 mm) filter is provided on the plenum inlet and attaches to the unit with a filter frame. Additional filtration options include a 1-inch MERV 8 and 2-inch MERV13.

Thinline Suppressor Attenuator (LPxF)

The Thinine Suppressor sound attenuator option is factory assembled and installed on plenum air inlet which is opposite the controls inlet side. The exclusive Trane design provides acoustical attenuation with a compact footprint. Unit sound performance is assured through rigorous testing in accordance with AHRI 880 test procedures.

Thinline Suppressor casing is constructed of 22-gauge galvanized steel, and lined with 1-inch glass fiber with high density facing or 1-inch glass density fiber with foil facing. Suppressor insulation liner will be 1-inch glass fiber with high density facing when unit insulation liner is 1-inch glass fiber with high density facing. For all other unit insulation liners, the Suppressor insulation liner will be 3/8-inch closed cell foam. The insulation is UL listed and meets NFPA 90A and UL 181 requirements. Foil faced insulation also meets bacteriological standard ASTM C 665.

Hot Water Coil

Factory installed on the plenum inlet fan discharge. All hot water coils have 144 aluminum-plated fins per foot (0.305 m). Full fin collars provided for accurate fin spacing and maximum fin-tube contact. The 3/8-inch (9.5 mm) OD seamless copper tubes are mechanically expanded into the fin collars. Coils are proof tested at 450 psig (3102 kPa) and leak tested at 300 psig (2068 kPa) air pressure under water. Coil connections are brazed. Standard top and bottom gasketed access panels are attached with screws.

Electric Heat Coil

The electric heater is a factory-provided and installed. It also contains a disc-type automatic pilot duty thermal primary cutout, and manual reset load carrying thermal secondary device. Heater element material is nickel-chromium. The heater terminal box is provided with 7/8-inch (22 mm) knockouts for customer power supply. Terminal connections are plated steel with ceramic insulators. All fan-powered units with electric reheat are single-point power connections.

Electric Heat Options

Silicon-Controlled Rectifier (SCR) — Optional 0 to 10 Vdc electric heat control that provides modulation.

Solid State Relay (SSR) — Optional electric 24 Vac solid-state contactor(s) for use with direct digital controls.

Magnetic Contactor — Optional electric heater 24V contactor(s) for use with direct digital controls.

Airflow Switch — Standard air pressure device designed to disable heater when terminal fan is off.

Power Fuse — If a power fuse is chosen with a unit containing electric heat, then a safety fuse is located in the electric heater's line of power to prevent power surge damage to the electric heater. Any electric heat unit with a calculated MCA greater than or equal to 30 will have a fuse provided.

Disconnect Switch — A standard factory-provided door interlocking disconnect switch on the electric heater control panel disengages primary voltage to the terminal.

Direct Digital Controls

DDC Actuator – Trane 3-wire, 24-Vac, floating-point quarter turn control actuator with linkage release button. Actuator has a constant drive rate independent of load, a rated torque of 35 in-lb, a 90-second drive time, and is non-spring return. Travel is terminated by end stops at fully-opened and -closed positions. An integral magnetic clutch eliminates motor stall.

DDC Actuator (Belimo) – LMB24-3-T TN 3-wire, 24 Vac/dc, floating-point, quarter turn actuator with linkage release button. Actuator has constant drive rate independent of load, rated torque 45 in-lb, 95 sec drive time, and non-spring return. Travel is terminated by end stops at fully-opened and -closed positions. Internal electronic control prevents motor stall when motor reaches end stops.

Direct Digital Controller – Microprocessor-based terminal unit controllers provide accurate, pressure-independent control through the use of proportional integral control algorithm and direct digital control technology.

Controllers monitor zone temperature setpoints, zone temperature, zone temperature rate of change, and valve airflow. They can also monitor supply duct air temperature, CO_2 concentration and discharge air temperature via appropriate sensors. Controller is provided in an enclosure with 7/8-inch (22mm) knockouts for remote control wiring. A Trane zone sensor or Air-Fi® Interface Module paired with a Wireless Communications Sensor (WCS) is required.

DDC Zone Sensor – The controller senses zone temperature through a sensing element located in the zone sensor. In addition to the sensing element, zone sensor options may include an externally-adjustable setpoint, communications jack for use with a portable edit device, and an override button to change the individual controller from unoccupied to occupied mode. The override button has a cancel feature that will return the system to unoccupied. Wired zone sensors utilize a thermistor to vary the voltage output in response to changes in the zone temperature. Wiring to the controller must be 18- to 22-awg. twisted pair wiring. The setpoint adjustment range is 50 to 88°F (10 to 31°C). Depending upon the features available in the model of sensor selected, the zone sensor may require from a 2-wire to a 5-wire connection. Wireless zone sensors report the same zone information as wired zone sensors, but do so using radio transmitter technology and does not require interconnecting wiring from the zone sensor to the unit controller.

Digital Display Zone Sensor with Liquid Crystal Display (LCD) – A Liquid Crystal Display (LCD) displays setpoint or zone temperature. Sensor buttons allow user to adjust setpoints, and allow zone temperature readings to be turned on or off. Digital display zone sensor also includes a communication jack for use with a portable edit device, and an override button to change from unoccupied to occupied. Override button cancel feature returns system to unoccupied mode.

Unit Options

Power Fuse (VPCF, VPWF)

Optional power fuse is factory installed.

Hot Water Valves

Trane Water Valve

The valve is a field-convertible, 2-way or 3-way configuration and ships in two-way configuration with a plug in the B port. The intended fluid is water or water and glycol mix (50% maximum glycol). The actuator is a synchronous motor drive. The valve is driven to a predetermined position by the controller using a proportional plus integral control algorithm. If power is removed, the valve stays in its last position. The actuator is rated for plenum applications under UL 2043 and UL 873 standards.

- Pressure and temperature ratings: The valve is designed and tested in full compliance with ANSI B16.15 Class 250 pressure/temperature ratings, ANSI B16.104 Class IV control shutoff leakage, and ISA S75.11 flow characteristic standards.
- Flow capacity: 0.70 Cv, 1.7 Cv, 2.7 Cv, 5.0 Cv
- Overall diameter: ½–in. NPT
- Maximum allowable pressure: 300 psi (2068 kPa)
- Maximum operating fluid temperature: 201ºF (94°C)
- Maximum close-off pressure: 60 psi (0.4 MPa)
- Electrical rating: 3VA at 24 VAC
- 8–in. plenum rated cable with AMP Mate-N-Lok connector

Belimo Water Valve

The intended fluid is water or water and glycol (50% maximum glycol). The actuator is a synchronous motor drive. The valve is driven to a predetermined position by the controller using a proportional plus integral control algorithm. If power is removed, the valve stays in its last position. The actuator is rated for plenum applications under UL 2043 and UL 873 standards.

- Pressure and temperature ratings: The valve is designed and tested in full compliance with ANSI B16.15 Class 250 pressure/temperature ratings, ANSI B16.104 Class IV control shutoff leakage, and ISA S75.11 flow characteristic standards.
- Flow capacity: 0.3 Cv, 0.46 Cv, 0.8 Cv, 1.2 Cv, 1.9 Cv, 3.0 Cv, 4.7 Cv
- Overall diameter: ½–inch NPT
- Maximum allowable pressure: 600 psi (4137 kPa)
- Maximum operating fluid temperature: 201ºF (94°C)
- Maximum close-off pressure: 200 psi (1379 kPa)
- Electrical rating: 1VA at 24 Vac
- 8-inch plenum rated cable with AMP Mate-N-Lok connector.

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